AR Sandbox for OSU Civil Construction Engineering

2.0

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Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 2

Class Documentation

2.1 Edge Class Reference

The Edge class stores Network Road and Lane information and builds roads (Edges) for SUMO networks.

Inheritance diagram for Edge:

Public Member Functions

- void ClearData ()

  Clear all saved Network Road Data.
- void BuildEdges ()

  Parses the Road list and builds all valid Roads

Public Attributes

- List< Road > RoadList

  The list of the Networks roads.
- Shader **Road_Shader**
- float LANEWIDTH = 3.4f

  The width to make lanes in meters.

2.1.1 Detailed Description

The Edge class stores Network Road and Lane information and builds roads (Edges) for SUMO networks.

2.1.2 Member Function Documentation

2.1.2.1 BuildEdges()

```
void Edge.BuildEdges ( )
```

Parses the Road list and builds all valid Roads

2.1.2.2 ClearData()

```
void Edge.ClearData ( )
```

Clear all saved Network Road Data.

2.1.3 Member Data Documentation

2.1.3.1 LANEWIDTH

```
float Edge.LANEWIDTH = 3.4f
```

The width to make lanes in meters.

2.1.3.2 RoadList

```
List<Road> Edge.RoadList
```

The list of the Networks roads.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Edge.cs

2.2 Intersection Struct Reference

Properties

- string **Id** `[get, set]`
- string **Name** `[get, set]`
- string **Type** `[get, set]`
- string **X** `[get, set]`
- string **Y** `[get, set]`
- string **IncomingLanes** `[get, set]`
- string **InternalLanes** `[get, set]`
- string **Shape** `[get, set]`

The documentation for this struct was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Junction.cs

2.3 IntEvent Class Reference

Inheritance diagram for IntEvent:

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/MarkerAction.cs

2.4 Junction Class Reference

Junction class represents road network intersection.

Inheritance diagram for Junction:

Public Member Functions

- void ClearData ()

  Clear all current simulation data.
- void BuildJunction (Intersection inter, bool flat)

  Build an Intersection.
- void **Build** ()

Public Attributes

- Shader **Road_Shader**
- List< Intersection > **Junction_List**
- bool **Built**

2.4.1 Detailed Description

Junction class represents road network intersection.

2.4.2 Member Function Documentation

2.4.2.1 BuildJunction()

```
void Junction.BuildJunction (
            Intersection inter,
            bool flat )
```

Build an Intersection.

2.4.2.2 ClearData()

```
void Junction.ClearData ( )
```

Clear all current simulation data.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Junction.cs

2.5 Lane Struct Reference

A struct representing a Sumo Network Lane.

Properties

- string **Id** `[get, set]`
- string **Index** `[get, set]`
- string **Speed** `[get, set]`
- string **Length** `[get, set]`
- string **Width** `[get, set]`
- string **Allow** `[get, set]`
- string **Disallow** `[get, set]`
- string **Shape** `[get, set]`
- bool **Built** `[get, set]`
- string **DefaultSpeed** `[get, set]`
- bool **ConstructionZone** `[get, set]`

2.5.1 Detailed Description

A struct representing a Sumo Network Lane.

The documentation for this struct was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Edge.cs

2.6 MarkerAction Class Reference

Used to provide functionality to a marker. This script should only be attached to an Image Target.

Inheritance diagram for MarkerAction:

Public Member Functions

- void OnTrackableStateChanged (TrackableBehaviour.Status previousStatus, TrackableBehaviour.Status newStatus)

  Invoked by Vuforia whenever the status of an Image Target changes. This lets us know whether or not the marker is being tracked.
- void AddTriggerArea (Vector3 triggerPosition)

  Adds a point to the list of areas that trigger the event.
- void AddTriggerArea (Bounds triggerArea)

  Adds a Bounds to the list of areas that trigger the event.
- void AddTriggerAreas (IEnumerable< Vector3 > triggerPositions)

  Adds multiple points to the list of areas that trigger the event.
- void AddTriggerAreas (IEnumerable< Bounds > triggerAreas)

  Adds multiple Bounds to the list of areas that trigger the event.

Public Attributes

- IntEvent **atPositionEvent**
- float **timeForTrigger**
- float **xYTolerance**
- Transform **mainCameraTransform**
- float **ARCameraHeight**
- bool **rotateCamera**

2.6.1 Detailed Description

Used to provide functionality to a marker. This script should only be attached to an Image Target.

2.6.2 Member Function Documentation

2.6.2.1 AddTriggerArea() [1/2]

```
void MarkerAction.AddTriggerArea (
            Vector3 triggerPosition )
```

Adds a point to the list of areas that trigger the event.

Parameters

triggerPosition	The point to add as a trigger.

2.6.2.2 AddTriggerArea() [2/2]

```
void MarkerAction.AddTriggerArea (
            Bounds triggerArea )
```

Adds a Bounds to the list of areas that trigger the event.

Parameters

triggerArea	The area to add as a trigger.

2.6.2.3 AddTriggerAreas() [1/2]

```
void MarkerAction.AddTriggerAreas (
            IEnumerable< Vector3 > triggerPositions )
```

Adds multiple points to the list of areas that trigger the event.

Parameters

triggerPositions	The points to add as triggers.

2.6.2.4 AddTriggerAreas() [2/2]

```
void MarkerAction.AddTriggerAreas (
            IEnumerable< Bounds > triggerAreas )
```

Adds multiple Bounds to the list of areas that trigger the event.

Parameters

triggerAreas	The areas to add as triggers.

2.6.2.5 OnTrackableStateChanged()

```
void MarkerAction.OnTrackableStateChanged (
```

```
TrackableBehaviour.Status previousStatus,
TrackableBehaviour.Status newStatus )
```

Invoked by Vuforia whenever the status of an Image Target changes. This lets us know whether or not the marker is being tracked.

Parameters

previousStatus	The previous status of the Image Target
newStatus	The current status of the Image Target

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/MarkerAction.cs

2.7 MarkerChangeIntersection Class Reference

Inheritance diagram for MarkerChangeIntersection:

Public Member Functions

- void **SetTrafficLightIntersection** (int junctionIndex)
- void **SetStopSignIntersection** (int junctionIndex)

Public Attributes

- Material **trafficLightMaterial**
- Material **stopSignMaterial**
- GameObject **junctionsParentObject**
- TraciController **traciController**

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/MarkerChangeIntersection.cs

2.8 MarkerManager Class Reference

Provides global management and functionality for markers. There should only be one MarkerManager in the scene.

Inheritance diagram for MarkerManager:

Public Attributes

- bool **rotateCamera**
- Transform **mainCameraTransform**
- float **ARCameraHeight** = 4350f
- Text **uiText**
- List< MarkerAction > **markerActionScripts**

2.8.1 Detailed Description

Provides global management and functionality for markers. There should only be one MarkerManager in the scene.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/MarkerManager.cs

2.9 MarkerSetWorkZone Class Reference

Allows a marker to set a lane as a work zone. This script should only be attached to an Image Target with a MarkerAction component

Inheritance diagram for MarkerSetWorkZone:

Public Member Functions

- void ToggleWorkZone (int laneIndex)

  Called by MarkerAction when the event is triggered. Creates a work zone at the given road if it is not already set as a work zone. Removes a work zone from the given road if it is currently set as a work zone.
- void SetWorkZone (GameObject lane, string roadId)

  Creates a work zone for a given road.
- void RemoveWorkZone (GameObject lane, string roadId)

  Removes a work zone from a given road

Public Attributes

- GameObject **lanesParentObject**
- Material **roadMaterial**
- Material **workZoneMaterial**
- TraciController **traciController**

2.9.1 Detailed Description

Allows a marker to set a lane as a work zone. This script should only be attached to an Image Target with a MarkerAction component

2.9.2 Member Function Documentation

2.9.2.1 RemoveWorkZone()

```
void MarkerSetWorkZone.RemoveWorkZone (
            GameObject lane,
            string roadId )
```

Removes a work zone from a given road

Parameters

roadStruct	The Road struct holding the road's information
roadId	The road's game object

2.9.2.2 SetWorkZone()

```
void MarkerSetWorkZone.SetWorkZone (
            GameObject lane,
            string roadId )
```

Creates a work zone for a given road.

Parameters

laneStruct	The Road struct holding the road's information
roadId	The road's game object

2.9.2.3 ToggleWorkZone()

```
void MarkerSetWorkZone.ToggleWorkZone (
            int laneIndex )
```

Called by MarkerAction when the event is triggered. Creates a work zone at the given road if it is not already set as a work zone. Removes a work zone from the given road if it is currently set as a work zone.

Parameters

laneIndex	The list index for the road. This index should be the same between this script and MarkerAction.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/MarkerSetWorkZone.cs

2.10 Poly Struct Reference

Poly struct holds polygon data that represents arbitrary network shapes.

Properties

- string **Id** `[get, set]`
- string **Type** `[get, set]`
- string **Color** `[get, set]`
- string **Shape** `[get, set]`

2.10.1 Detailed Description

Poly struct holds polygon data that represents arbitrary network shapes.

The documentation for this struct was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Structure.↩ cs

2.11 ProjectionData Class Reference

Projection Data class stores and creates a simulation networks terrain.

Inheritance diagram for ProjectionData:

Public Member Functions

- void SetProjectionData (XmlDocument xml)

  Get the bounds of the current network as a pair of points in 2-Space
- List< float > ShapeStringToFloatList (string shape)

  Sumo shape sting to List of floats point order is x1, y1, x2, y2, ...
- void BuildTerrain ()

  Adds a Terrain_Plane to the scene the size of the network and sets the camera to the center of the plane.

Public Attributes

- Shader Terrain_Shader

  The Projection Data Terrain Shader.
- Camera Main_Camera

  A handle to the main camera.
- string offset

  The offset for network projections.
- string originalBounds

  The networks original bounds Lat/Lon
- string projectedBounds

  The networks projected bound. Cartesian

2.11.1 Detailed Description

Projection Data class stores and creates a simulation networks terrain.

2.11.2 Member Function Documentation

2.11.2.1 BuildTerrain()

```
void ProjectionData.BuildTerrain ( )
```

Adds a Terrain_Plane to the scene the size of the network and sets the camera to the center of the plane.

2.11.2.2 SetProjectionData()

```
void ProjectionData.SetProjectionData (
            XmlDocument xml )
```

Get the bounds of the current network as a pair of points in 2-Space

Parameters

xml	The xml file with the projection data.

2.11.2.3 ShapeStringToFloatList()

```
List<float> ProjectionData.ShapeStringToFloatList (
            string shape )
```

Sumo shape sting to List of floats point order is x1, y1, x2, y2, ...

Parameters

shape	A Sumo formatted shape string.

Returns

2.11.3 Member Data Documentation

2.11.3.1 Main_Camera

```
Camera ProjectionData.Main_Camera
```

A handle to the main camera.

2.11.3.2 offset

```
string ProjectionData.offset
```

The offset for network projections.

2.11.3.3 originalBounds

```
string ProjectionData.originalBounds
```

The networks original bounds Lat/Lon

2.11.3.4 projectedBounds

```
string ProjectionData.projectedBounds
```

The networks projected bound. Cartesian

2.11.3.5 Terrain_Shader

`Shader ProjectionData.Terrain_Shader`

The Projection Data Terrain Shader.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/ProjectionData.cs

2.12 Road Struct Reference

A struct representing a Sumo Network Edge.

Properties

- string **Id** `[get, set]`
- string **From** `[get, set]`
- string **To** `[get, set]`
- string **Name** `[get, set]`
- string **Shape** `[get, set]`
- bool **Built** `[get, set]`
- string **Type** `[get, set]`
- string **Function** `[get, set]`
- List< Lane > **Lanes** `[get, set]`
- float **Occupancy** `[get, set]`

2.12.1 Detailed Description

A struct representing a Sumo Network Edge.

The documentation for this struct was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Edge.cs

2.13 Structure Class Reference

Structure class stores and builds all simulation network buildings and Points of Interest.

Inheritance diagram for Structure:

Public Member Functions

- void ClearData ()

  Clear all current simulation polygon data.
- void Build ()

  Build all stored polygon data.

Public Attributes

- List< Poly > Polys

  The list of polygon data.
- Shader Road_Shader

  The parking lot shader.
- Shader Building_Shader

  The building extrusion shader.

2.13.1 Detailed Description

Structure class stores and builds all simulation network buildings and Points of Interest.

2.13.2 Member Function Documentation

2.13.2.1 Build()

```
void Structure.Build ( )
```

Build all stored polygon data.

2.13.2.2 ClearData()

```
void Structure.ClearData ( )
```

Clear all current simulation polygon data.

2.13.3 Member Data Documentation

2.13.3.1 Building_Shader

```
Shader Structure.Building_Shader
```

The building extrusion shader.

2.13.3.2 Polys

```
List<Poly> Structure.Polys
```

The list of polygon data.

2.13.3.3 Road_Shader

```
Shader Structure.Road_Shader
```

The parking lot shader.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Structure.cs

2.14 SumoCreator Class Reference

SumoCreator class is used for creating Open Street Map networks with SUMO's OSM Web Wizard and reading SUMO generated files that describe a networks logic and layout.

Inheritance diagram for SumoCreator:

Public Member Functions

- void GenerateOsmNetwork ()

  Open the OSMWebWizard to build a real world road network. The user will save the new network to a zipfile when done. The processes remain open so the user can build multiple network at once.
- void LoadNetwork ()

  Go through all network description files and build the network into Unity. Most files will be passed over but there are some handles left for upgrades.

2.14.1 Detailed Description

SumoCreator class is used for creating Open Street Map networks with SUMO's OSM Web Wizard and reading SUMO generated files that describe a networks logic and layout.

2.14.2 Member Function Documentation

2.14.2.1 GenerateOsmNetwork()

```
void SumoCreator.GenerateOsmNetwork ( )
```

Open the OSMWebWizard to build a real world road network. The user will save the new network to a zipfile when done. The processes remain open so the user can build multiple network at once.

2.14.2.2 LoadNetwork()

```
void SumoCreator.LoadNetwork ( )
```

Go through all network description files and build the network into Unity. Most files will be passed over but there are some handles left for upgrades.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Sumo↩ Creator.cs

2.15 TraciController Class Reference

Traci Controller class manages a running simulation by communicating with a Sumo process.

Inheritance diagram for TraciController:

Public Member Functions

- void RemoveWorkZoneOnLane (string roadId, string laneId)

  Removes the construction zone attribute for a defined lane in the given road, and updates the simulation in SUMO.
- void RemoveWorkZoneEntireRoad (string roadId)

  Removes the construction zone attribute from every lane in the road, and updates the simulation accordingly in SUMO.
- void SetWorkZoneEntireRoad (string roadId)

  Sets the construction zone attribute for every lane in the road, and updates the simulation accordingly in SUMO.
- void SetWorkZoneOneLane (string roadId, string laneId)

  Sets the construction zone attribute for a defined lane in the given road, and updates the simulation in SUMO.
- void ToggleMesoscopic ()

  Flips the Occupancy Visual to simulate a mesoscopic view.
- void SetStopSignJunction (string trafficLightId)

  Sets a junction's stop light to the "off-blinking" phase to cause all vehicles to yeild
- void SetTrafficLightJunction (string trafficLightId)

  Sets a junction's stop light to the default phase to cause all vehicles to yeild
- void Subscribe ()

  Subscribes to all vehicles in the simulation
- void OnVehicleUpdate (object sender, Traci.Types.SubscriptionEventArgs e)

  Event handler to handle a car update event

Public Attributes

- GameObject Cars_GO

  The Car main Game Object
- float speed = 2.0f

  The simulation speed.
- Traci.TraCIClient Client

  The Traci client.
- String HostName

  The hostname of the computer for remote connections.
- int Port

  The post of the computer for remote connections.
- String ConfigFile

  The current simulation config file.
- bool OccupancyVisual

  Flag to determine if the road color should be set
- bool CarVisual

  Flag to determine if car positions should be shown.

2.15.1 Detailed Description

Traci Controller class manages a running simulation by communicating with a Sumo process.

2.15.2 Member Function Documentation

2.15.2.1 OnVehicleUpdate()

```
void TraciController.OnVehicleUpdate (
            object sender,
            Traci.Types.SubscriptionEventArgs e )
```

Event handler to handle a car update event

Parameters

sender	The client
e	The event args

2.15.2.2 RemoveWorkZoneEntireRoad()

```
void TraciController.RemoveWorkZoneEntireRoad (
            string roadId )
```

Removes the construction zone attribute from every lane in the road, and updates the simulation accordingly in SUMO.

Parameters

roadId	The ID of the road to update

2.15.2.3 RemoveWorkZoneOnLane()

```
void TraciController.RemoveWorkZoneOnLane (
            string roadId,
            string laneId )
```

Removes the construction zone attribute for a defined lane in the given road, and updates the simulation in SUMO.

Parameters

roadId	The ID of the road to which the lane belongs
laneId	The lane Id as specified in the SUMO network file

2.15.2.4 SetStopSignJunction()

```
void TraciController.SetStopSignJunction (
            string trafficLightId )
```

Sets a junction's stop light to the "off-blinking" phase to cause all vehicles to yeild

Parameters

trafficLightId	The id of the stop light/junction that will be converted

2.15.2.5 SetTrafficLightJunction()

```
void TraciController.SetTrafficLightJunction (
            string trafficLightId )
```

Sets a junction's stop light to the default phase to cause all vehicles to yeild

Parameters

trafficLightId	The id of the stop light/junction that will be converted

2.15.2.6 SetWorkZoneEntireRoad()

```
void TraciController.SetWorkZoneEntireRoad (
            string roadId )
```

Sets the construction zone attribute for every lane in the road, and updates the simulation accordingly in SUMO.

Parameters

roadId	The ID of the road to update

2.15.2.7 SetWorkZoneOneLane()

```
void TraciController.SetWorkZoneOneLane (
            string roadId,
            string laneId )
```

Sets the construction zone attribute for a defined lane in the given road, and updates the simulation in SUMO.

Parameters

roadId	The ID of the road to which the lane belongs
laneId	The lane Id as specified in the SUMO network file

2.15.2.8 Subscribe()

```
void TraciController.Subscribe ( )
```

Subscribes to all vehicles in the simulation

2.15.2.9 ToggleMesoscopic()

```
void TraciController.ToggleMesoscopic ( )
```

Flips the Occupancy Visual to simulate a mesoscopic view.

2.15.3 Member Data Documentation

2.15.3.1 Cars_GO

```
GameObject TraciController.Cars_GO
```

The Car main Game Object

2.15.3.2 CarVisual

```
bool TraciController.CarVisual
```

Flag to determine if car positions should be shown.

2.15.3.3 Client

```
Traci.TraCIClient TraciController.Client
```

The Traci client.

2.15.3.4 ConfigFile

```
String TraciController.ConfigFile
```

The current simulation config file.

2.15.3.5 HostName

```
String TraciController.HostName
```

The hostname of the computer for remote connections.

2.15.3.6 OccupancyVisual

```
bool TraciController.OccupancyVisual
```

Flag to determine if the road color should be set

2.15.3.7 Port

```
int TraciController.Port
```

The post of the computer for remote connections.

2.15.3.8 speed

```
float TraciController.speed = 2.0f
```

The simulation speed.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Traci↩ Controller.cs

2.16 Traffic_Light Struct Reference

A struct representing a Sumo Network TrafficLight.

Properties

- string **Id** `[get, set]`
- List< string > **ControlledLanes** `[get, set]`
- string **Program** `[get, set]`
- float **PhaseDuration** `[get, set]`

2.16.1 Detailed Description

A struct representing a Sumo Network TrafficLight.

The documentation for this struct was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Traffic↩ Light.cs

2.17 TrafficLight Class Reference

Inheritance diagram for TrafficLight:

Public Member Functions

- void **Get_Traffic_Lights** ()

Public Attributes

- List< Traffic_Light > **TL_List**

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Traffic↩ Light.cs

2.18 Triangulator Class Reference

Public Member Functions

- **Triangulator** (Vector2[ ] points)
- int [ ] **Triangulate** ()

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/Triangulator.↩ cs

2.19 UserController Class Reference

Inheritance diagram for UserController:

Public Attributes

- Camera **Main_Camera**
- GameObject **Canvas**
- float **speed** = 2.0f

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/User↩ Controller.cs

2.20 VirtualButtonAction Class Reference

Provides a simple, abstract interface for virtual buttons that can be used from the Unity editor. This script must be attached to a Virtual Button.

Inheritance diagram for VirtualButtonAction:

Public Member Functions

- void **OnButtonPressed** (VirtualButtonBehaviour vb)
- void **OnButtonReleased** (VirtualButtonBehaviour vb)

Public Attributes

- UnityEvent **onButtonDown**
- UnityEvent **onButtonUp**

2.20.1 Detailed Description

Provides a simple, abstract interface for virtual buttons that can be used from the Unity editor. This script must be attached to a Virtual Button.

The documentation for this class was generated from the following file:

- C:/Users/Documents/GitHub/AR-Sandbox-for-Construction-Planning/src/AR_Sumobox/Assets/Scripts/↩ Markers/VirtualButtonAction.cs