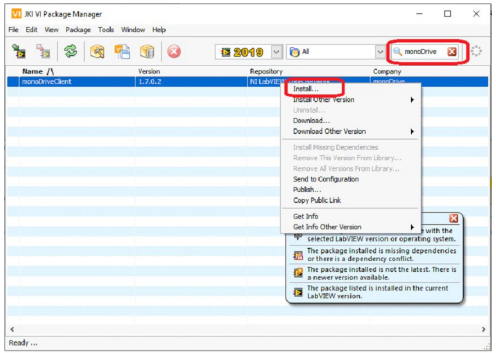
Quick-Start Guide

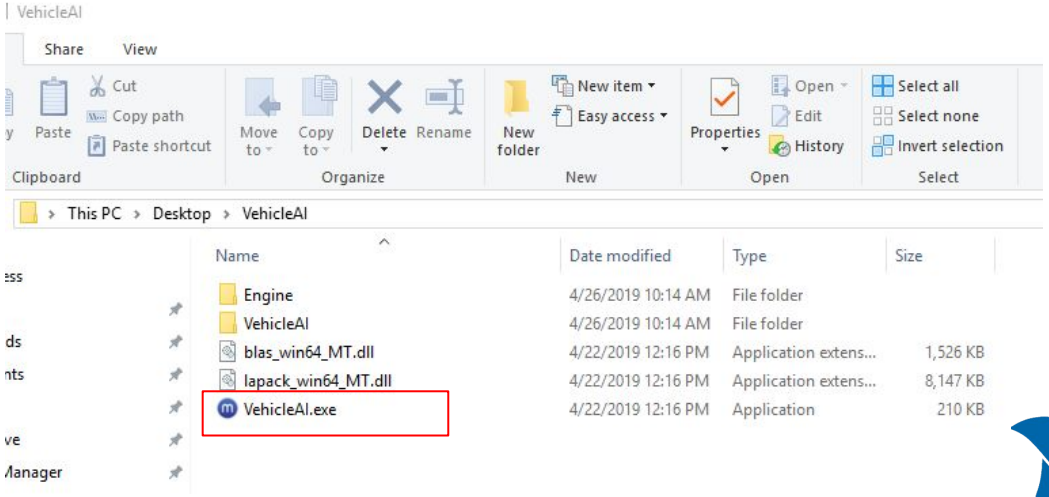
Prerequisites

1. Download LabVIEW 2019 (64-bit)
2. Install Unreal Engine from here
3. Download the monoDrive simulator from here
4. Install the monoDrive Client from the VI Package Manager



Run the VehicleAI simulator

1. Run the simulator : Go to your VehicleAI directory and find VehicleAI.exe
2. Double-click on VehicleAI.exe
3. Move to one side of your screen.

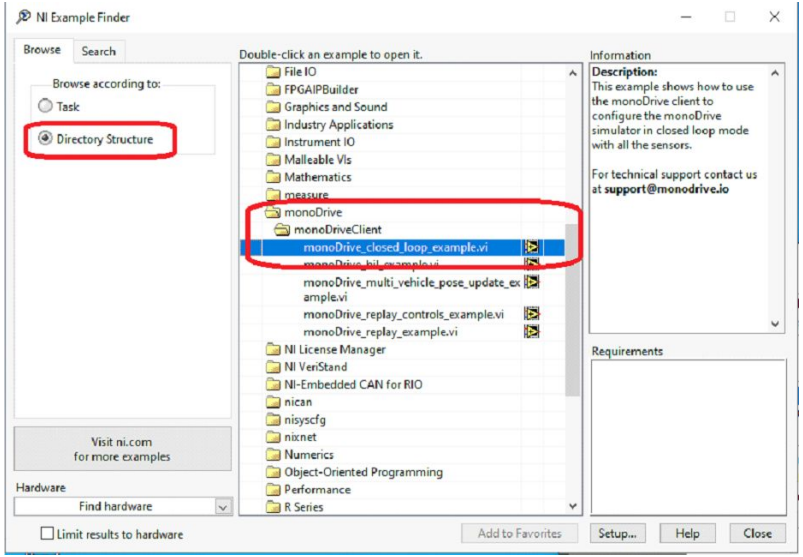


Open the LabVIEW Client

1. Navigate to the monoDriveClient folder, you can find it on your NI Examples, typically on:

   C:\Program Files\National Instruments\LabVIEW 2019\examples\monoDrive\monoDriveClient

You can also find the examples on the NI example Finder.



Open the LabVIEW Client

1. You will find find 5 examples. Each of them shows one of the modes supported by the monoDrive simulator.
   a. monoDrive_closed_loop_example.vi
   b. monoDrive_hil_example.vi
   c. monoDrive_multi_vehicle_pose_update_example.vi
   d. monoDrive_replay_example.vi
   e. monoDrive_replay_controls_example.vi
2. Double-click on it to open.

Run the monoDrive Client - Closed Loop example

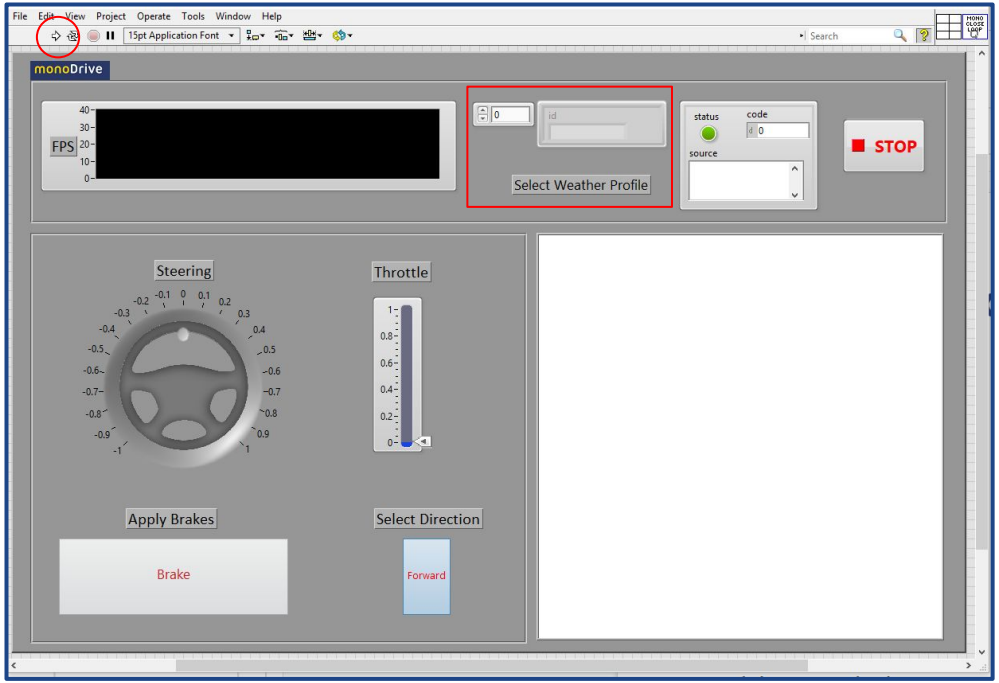
1. Click on the arrow on the top-left corner to start the client.

2. Move the car using the Steering and Throttle controls.

3. Change the direction of the car using the forward control.

4. Apply brakes using the Brake control.

5. Change the Weather profile using the up and down control.



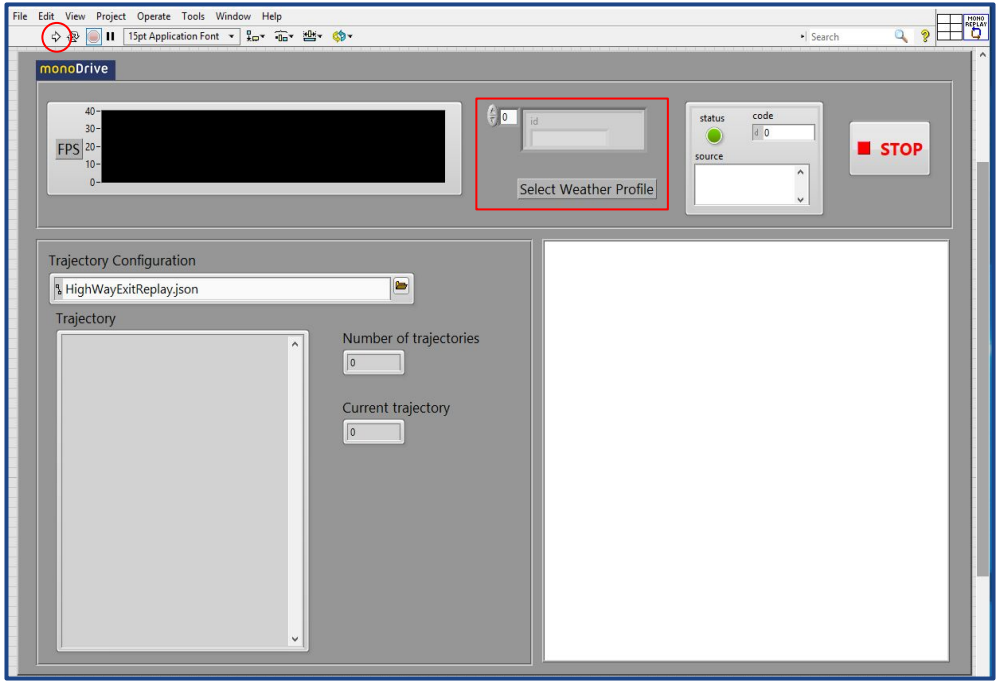
Run the monoDrive Client - Replay example

1. Click on the arrow on the top-left corner to start the client.

2. Change the Weather profile using the up and down control.

3. Use the browser button to find other scenarios, you can find them typically on:

C:\Program Files (x86)\National Instruments\LabVIEW 2019\vi.lib\monoDrive\monoDriveClient\labview\trajectories



Run the monoDrive Client - Replay controls

1. Click on the arrow on the top-left corner to start the client.

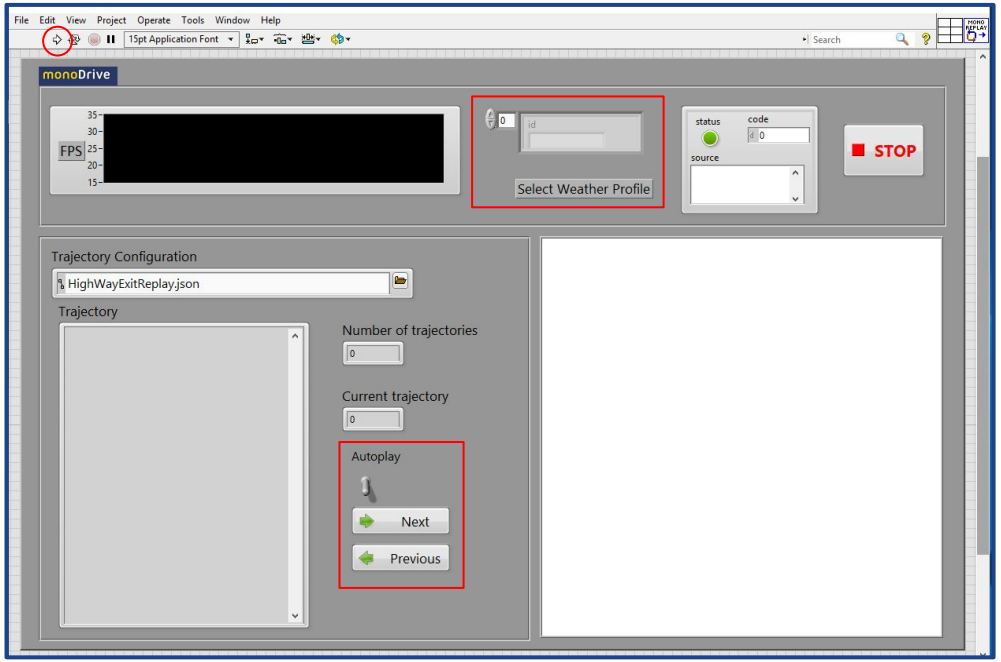
2. By default the Autoplay will be set to False. Click on the Next button to see the first frame on the trajectory.

3. Click on Previous to go back one frame on the trajectory.

4. Change the Weather profile using the up and down control.

5. Use the browser button to find other scenarios, you can find them typically on:

C:\Program Files\National Instruments\LabVIEW 2019\vi.lib\monoDrive\monoDriveClient\labview\trajectories



Run the monoDrive Client - HIL example

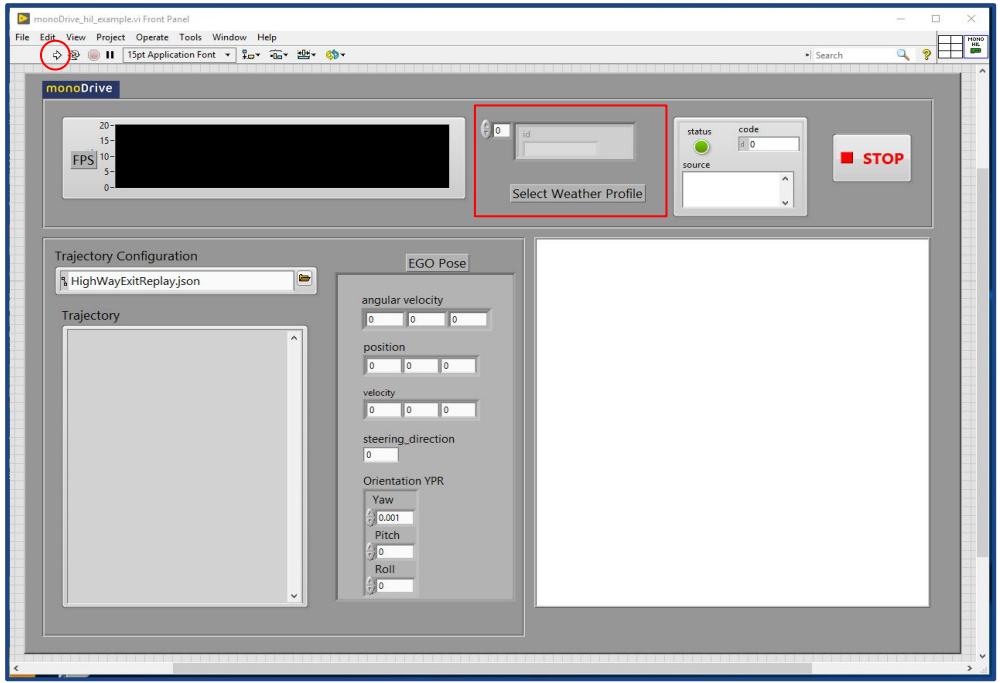
1. Click on the arrow on the top-left corner to start the client.

2. Change the Weather profile using the up and down control.

3. This example is meant to be used with Veristand or other real-time hardware.

4. Use the browser button to find other scenarios, you can find them typically on:

C:\Program Files\National Instruments\LabVIEW 2019\vi.lib\monoDrive\monoDriveClient\labview\trajectories

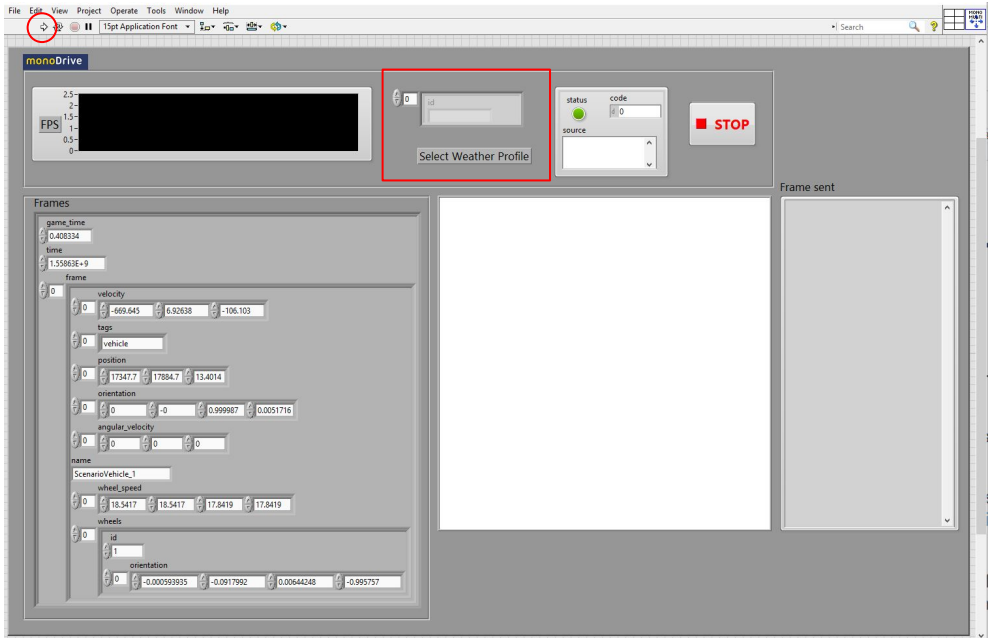


Run the monoDrive Client - Multi vehicle pose update example.

1. Click on the arrow on the top-left corner to start the client.

2. You will see the EGO vehicle moving as well other vehicles according to the Frames configuration.

3. On the block diagram is explained how to replace

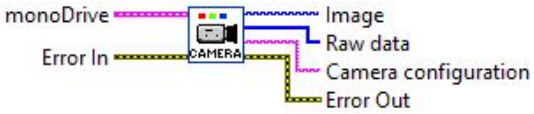


Simulator Configuration


```
{
 "id": "simulator_test",
 "server_ip": "127.0.0.1",
 "server_port": 8999,
 "client_ip": "127.0.0.1",
 "simulation_mode": 0,
 "phys_materials": {
   "Aluminum": {
     "specular_exponent": 15.0,
     "specular_coefficient": 0.95,
     "diffuse_coefficient": 0.26,
     "dielectric_constant": 10.0,
     "roughness": 0.15
   },
...
 },
 "traffic_configuration": {
   "max_vehicles": 40,
   "spawn_rate": 0.25
 },
 "client_settings": {
   "map": {
     "gis_anchor": { "x": 0, "y": 0, "z": 0},
     "point_delta": 100.0
   }
 }
}
```

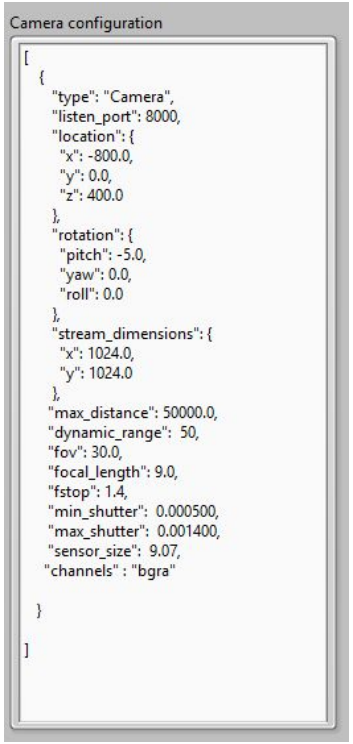

Configures the material properties for the elements in the simulation such as the road, concrete, steel ,etc. Also configures the maximum number of cars on the road and the rate at which they are spawn.

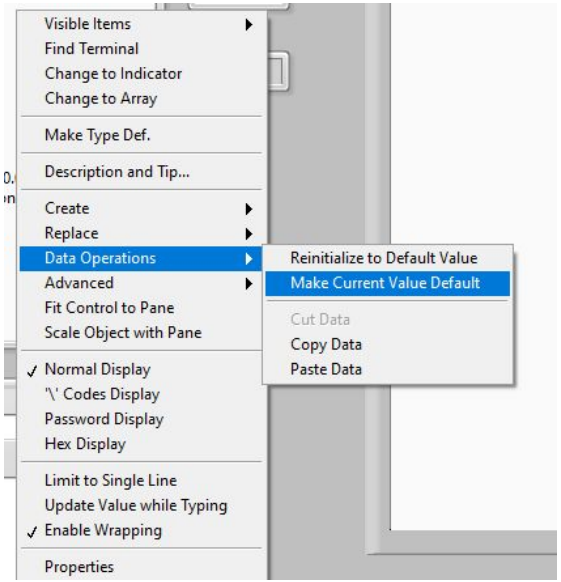
Sensor Configuration



To change the configuration of any sensor, double-click on the sensor subVI and make the changes you need.

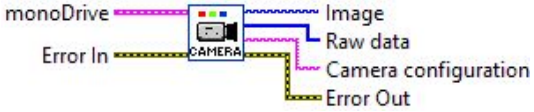
Make sure you save the configuration as default value so that is persistent the next time you open your application.





Sensor Configuration


```
{
    "type": "Camera",
   "id": "0",
   "packet_size" : 23552,
   "listen_port" : 8081,
   "display_process" : false,
   "sensor_process" : false,
   "location" : {
     "x": -800.0,
     "y": 0.0,
     "z": 400.0
   },
   "rotation" : {
     "pitch": -15.0,
     "yaw": 0.0,
     "roll": 0.0
   },
   "max_distance" : 50000.0,
   "horizontal_fov_angle" : 50.0,
   "fps": 1.0,
   "stream_dimensions" : {
     "x": 768.0,
     "y": 768.0
   },
   "semantic_processing" : false,
   "hdmi_streaming" : false
}
```

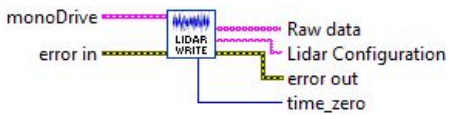




```
{
    "type": "GPS",
   "id": "5",
   "packet_size" : 1472,
   "listen_port" : 8090,
   "display_process" : true,
   "sensor_process" : true,
   "synchronized_display" : true,
   "location" : {
     "x": -75.0,
     "y": -25.0,
     "z": 245.0
   },
   "rotation" : {
     "pitch": 0.0,
     "yaw": 0.0,
     "roll": 0.0
   },
   "fps": 1.0
}
```


NOTE: Make sure the “listen_port” chosen is not used by another process or sensor.

Sensor Configuration


```
{
 "type": "Lidar",
 "id": "0",
 "packet_size" : 1472,
 "listen_port" : 8093,
 "display_process" : true,
 "sensor_process" : true,
 "synchronized_display" : true,
 "location" : {
   "x":-75.0,
   "y":-25.0,
   "z":350.0
 },
 "rotation" : {
   "pitch":0.0,
   "yaw":0.0,
   "roll":0.0
 },
 "max_distance" : 8000.0,
 "vertical_fov_angle" : 30.0,
 "horizontal_resolution" : 0.4,
 "fps": 1.0,
 "n_lasers": 32,
 "reset_angle": 0.0
}
```

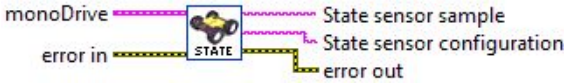

```
{
 "type": "Radar",
 "id": "2",
 "packet_size": 64000,
 "listen_port": 8092,
 "display_process" : true,
 "sensor_process" : true,
 "synchronized_display" : true,
 "location" : {
   "x": 250.0,
   "y": 0.0,
   "z": 50.0
 },
 "rotation" : {
   "pitch": 0.0,
   "yaw": 0.0,
   "roll": 0.0
 },
 "num_samples_per_sweep" : 1100,
 "fs": 150000000,
 "fc": 77000000000.0,
 "num_sweeps": 64,
 "range_max": 150.0,
 "sweep_num_for_range_max" : 5.5,
 "range_resolution" : 1.0,
 "max_velocity" : 100.0,
 "max_targets" : 100,
 "fps": 1.0,
 "elements" : 8,
 "transmitter" : {
   "peak_power" : 5.0,
   "aperture" : 0.000859,
   "gain": 13.5
 },
 "receiver" : {
   "aperture" : 0.000798,
   "nf": 10.0,
   "noise_temp" : 290.0,
   "nb": 74000000.0,
   "gain" : 20.0,
   "kb": 0.00059641065
 },
 "sbr" : {
    "minimum_radar_distance" : 5.0,
    "long_range_scan_distance" :
150.0,
    "short_range_scan_distance" :
60.0,
    "num_scans_azimuth" : 20.0,
    "long_range_fov" : 20.0,
    "short_range_fov" : 90.0,
    "num_scans_elevation" : 10.0,
    "elevation_fov" : 5.0,
    "max_raycast_hits" : 1
 }
}
```


NOTE: Make sure the “listen_port” you select is not used by another process or sensor.

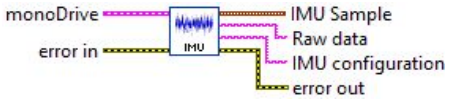
Sensor Configuration

```
{
  "type": "RPM",
  "id": "0",
  "packet_size" : 1472,
  "listen_port" : 8086,
  "display_process" : false,
  "sensor_process" : false,
  "location" : {
    "x": 0,
    "y": 0,
    "z": 0
  },
  "rotation" : {
    "pitch": 0,
    "yaw": 0,
    "roll": 0
  },
  "fps": 1.0,
  "wheel_number" : 0
}
```


```
{
  "type": "State",
  "id": "0",
  "fps": 1.0,
  "listen_port" : 8777,
  "packet_size" : 1472,
  "display_process" :
false,
  "sensor_process" : true,
  "debug_drawing" : true,
  "desired_tags" : [
    "vehicle"
  ],
"undesired_tags" : [
"static"
]
}
```

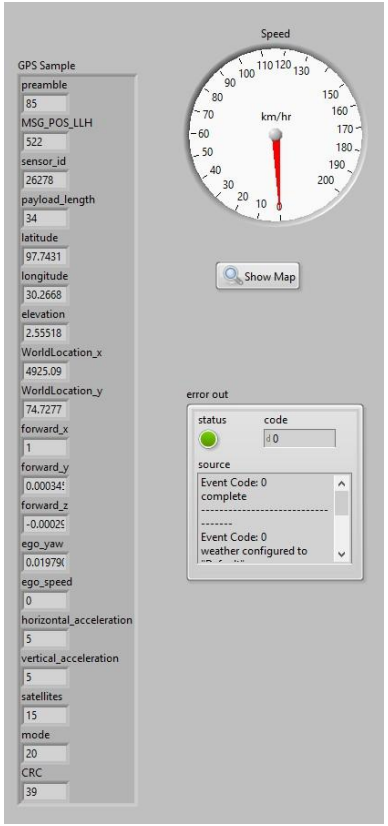


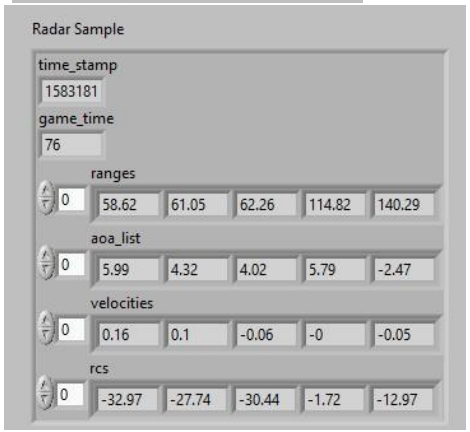

```
{
  "type": "IMU",
  "id": "0",
  "packet_size" : 1472,
  "listen_port" : 8091,
  "display_process" : true,
  "sensor_process" : true,
  "synchronized_display" : true,
  "location" : {
    "x":-75.0,
    "y":-25.0,
    "z":245.0
  },
  "rotation" : {
    "pitch":0.0,
    "yaw":0.0,
    "roll":0.0
  },
  "fps": 1.0
}
```

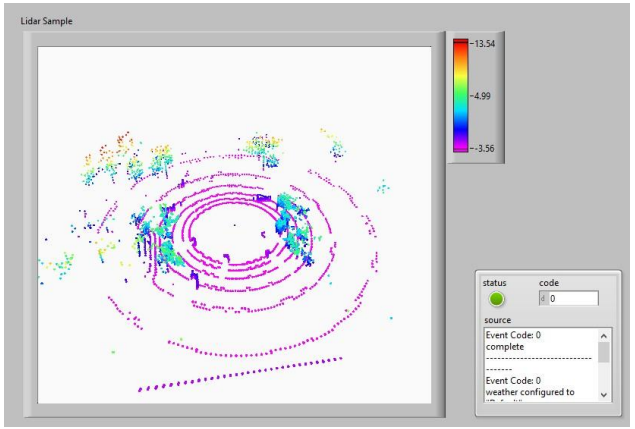


NOTE: Make sure the “listen_port” you select is not used by another process or sensor

Sensor Output





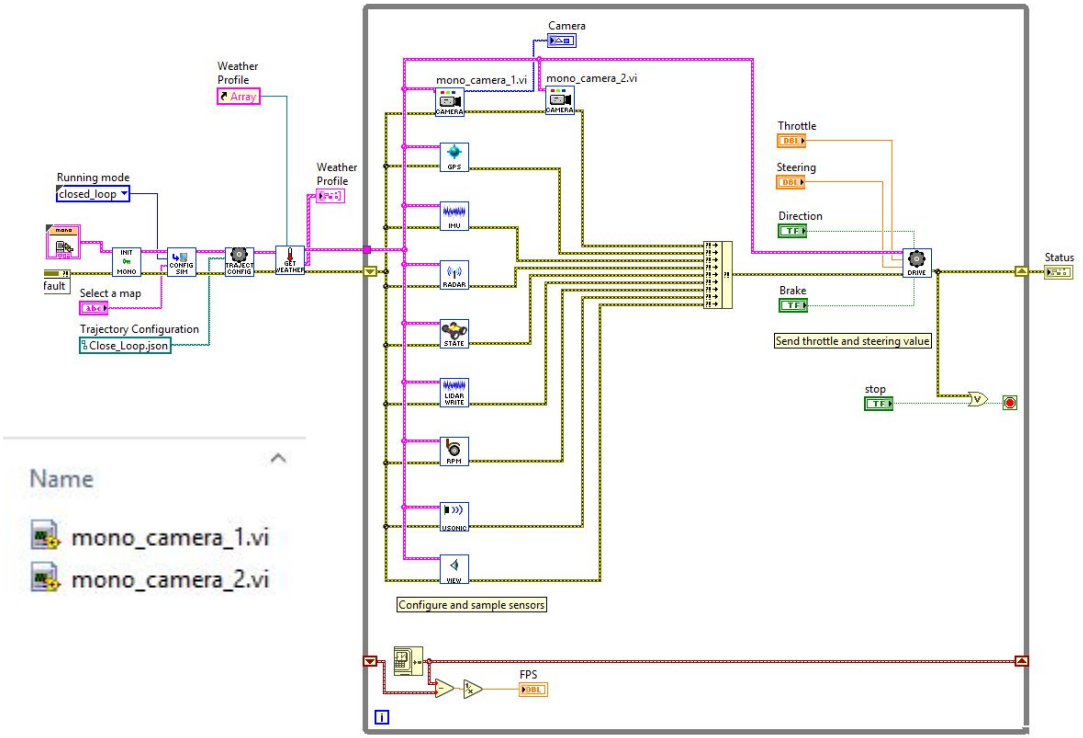


Double-click on each sensor to look at the output of each sensor while running.

Add Sensors

The easiest way to add a new sensor to your application is to create a copy of the sensor you need (on your directory explorer). Change the port for communication for the second sensor.

Then grab and drop the second sensor into your application and connect appropriately.



Trajectory Configuration File


```
[
    {
        "frame": [
            {
                "angular_velocity": [
                    -2.444333949824795e-05 ,
                    0.005100168287754059,
                    0.0002663454506546259
                ],
                "name": "ScenarioVehicle_1" ,
                "orientation" : [
                    -0.0001492226729169488,
                    1.4324657968245447e-05,
                    -0.7113564014434814,
                    0.702831506729126
                ],
                "position" : [
                    15015.98828125,
                    15328.6845703125,
                    15.90130615234375
                ],
                "steering_direction" :
0.305339515209198 ,
                "tags": [
                    "vehicle",
                    "dynamic",
                    "ego"
                ],
                "velocity" : [
                    -0.6869845390319824,
                    -1.3215781450271606,
                    -37.32944107055664
                ]
            },
            {
                "angular_velocity" : [
                    -0.02693433128297329,
                    -0.030446365475654602,
                    0.00673380121588707
                ],
                "name" : "ScenarioVehicle2" ,
                "orientation" : [
                    -0.0005045104771852493,
                    0.00018088216893374 92,
                    0.7072895169258118,
                    0.7069238424301147
                ],
                "position" : [
                    13788.91796875,
                    15402.078125,
                    15.537322998046875
                ],
                "steering_direction" :
-0.042938876897096634,
                "tags" : [
                    "vehicle",
                    "dynamic"
                ],
                "velocity": [
                    1.838138461112976,
                    656.9227294921875,
                    -40.23637390136719
                ]
            },
            ...,
        "game_time" :
0.40833351016044617 ,
        "time" : 1554502011
    },
    {
        "frame": [
            { ...,
    }

]
```


The client ships with some sample trajectory files, usually under

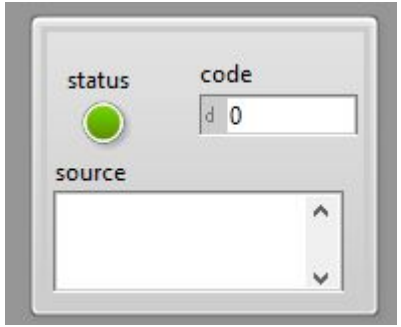
C:\Program Files (x86)\National Instruments\LabVIEW 2019\vi.lib\monoDrive\monoDriveClient\labview\trajectories

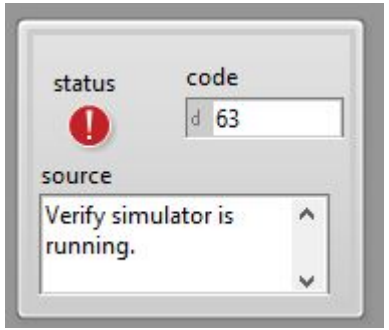
Weather Configuration


```
{
"set_profile" : "CloudySunset",
"profiles" : [
"id": "Default",
"SunPolarAngle": 44.586,
"SunAzimuthAngle": 174,
"SunBrightness" : 50,
"SunDirectionalLightIntensity" : 15.092,
"SunDirectionalLightColor" : {
   "R": 255.0,
   "G": 239.0,
   "B": 194.0,
   "A": 1.0
   },
"SunIndirectLightIntensity" : 6,
"CloudOpacity": 16.296,
"HorizontFal loff": 3,
"ZenithColor": {
      "R": 0.034046,
      "G": 0.109247,
      "B": 0.295,
      "A": 1.0
    },
"HorizonColor" : {
    "R": 0.659853, "G": 0.862215, "B": 1.0, "A": 1.0
},
"CloudColor": {
      "R": 0.855778, "G": 0.919005, "B": 1.0, "A": 1.0
    },
    "OverallSkyColor": {
      "R": 1.0, "G": 1.0, "B": 1.0, "A": 1.0
    },
    "SkyLightIntensity": 5.505,
    "SkyLightColor": {
      "R":0.149650, "G":0.161819, "B":0.205000, "A":0.000000
    },
    "bPrecipitation": false,
    "PrecipitationType": "Rain",
    "PrecipitationAmount": 0,
    "PrecipitationAccumulation": 0,
    "bWind": false,
    "WindIntensity": 20,
    "WindAngle": 0,
    "bOverrideCameraPostProcessParameters": true,
    "CameraPostProcessParameters": {
        "AutoExposureMethod": "Histogram",
        "AutoExposureMinBrightness": 0.27,
        "AutoExposureMaxBrightness": 5,
        "AutoExposureBias": - 3.5
    }
...
]
```


Errors

If an error occurred during the execution, the error cluster will give you information on the error.

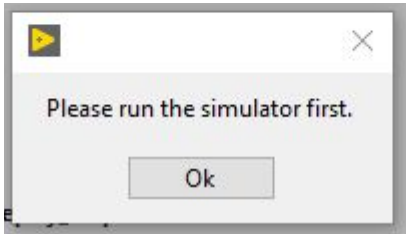




FAQ

1. I clicked on the top-left arrow and the client stopped.
Look at the Error cluster on the right corner look if there is any error.

2. I get this pop-up when I ran the simulator



The simulator is not running. Go to your VehicleAI directory and double click on the VehicleAI.exe, then try again.

FAQ

4. I got error 63.

“TCP Open Connection in monoDrive.lvlib:mono_connect.vi->monoDrive.lvlib:mono_init.vi->monoDrive_closed_loop_example.vi”

The client couldn’t connect to the server, make sure the simulator is running and the client is connected to port 8999

FAQ

5. I got error 56.

This means the client hit a timeout, this happens if the port for any sensor is duplicated. Make sure every sensor has a unique port number in its configuration.