

## Milestone 1

### Open Loop controller

#### ARTICLE 1: Objective

The objective of the milestone is testing your capabilities to operate a vehicle inside a simulation environment with an open loop control to follow 4 different trajectories:

- Move in a straight line with length 75 m.
- Draw a circle with a car, the circle must has a radius of 6 m.
- Move in a straight line with length 75 m then change to the left lane knowing that the lane width is 3.7 m, and then continue going in a straight line with length 75m.
- Draw an infinity shape with the same start and end point at the center of shape with minor radius 6 m and major radius 8 m.
- No sensors should be used as a feedback element, as this mission focus is open loop control.

As an example of what should do: [example](#) (Note this example just for illustration).

Also you can find an example of the 4 tracks in plane view available at EVER Academy on Udemy.

#### ARTICLE 2: Requirements

- Draw the four shapes that is mentioned above in the simulator with the car spawned in them.
- Make a CSV file that contain the position of the car during the simulation and the total time taken to complete each path.
- Record a video for each path.
- The submission should contain:
  - A video for each path.
  - The workspace that contains the written code and the packages used.
  - A report that contains the following:
    - The methodology used to solve the problem of moving in the required path.
    - The written code to solve the problem.



### ARTICLE 3: Submission criteria:

- The submission will be judged according to following:
  - Total time taken to complete each path.
  - The accuracy of each path moved by the car compared to the required path.
  - How many paths have been completed.

### ARTICLE 4: Notes

- Codes will be subjected to a plagiarism checker to validate authenticity.
- No late submissions will be accepted.

### ARTICLE 5: Simulator

- The simulator that will be used is CoppeliaSim V4.5.1 rev4.

### ARTICLE 6: Car information

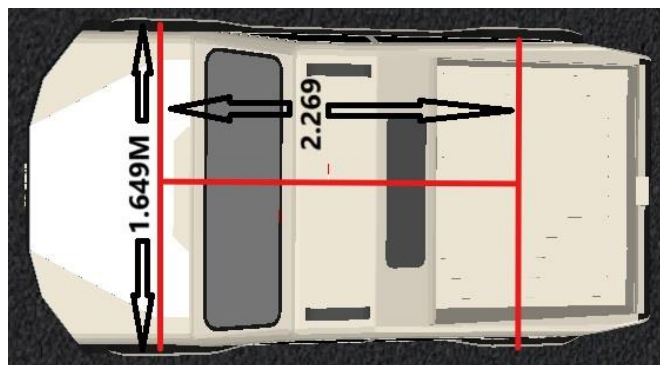


Figure 1 Car dimensions in meter.

## ARTICLE 7: Car specs

Parameter	Value	Unit
Car Mass	600	Kg
Spring Constant	112000	N/m
C	1280	Kg/sec.
Wheel Track	1.649	m
Wheelbase	2.269	m
Maximum Torque Delivered to the wheel	$1.311 \times 10^4$	N.m
Steering Rate	70	°/sec.
Steering Torque	1000	N.m
Static Friction Coefficient	0.9	Unitless
Dynamic Friction Coefficient	0.7	Unitless
Maximum Turning Steering Angle	30	° (Degree)

## ARTICLE 8: ROS1 Topics

```
/SteeringAngle #subscriber
# Type: std_msgs/Float64
# info: used to set the steering angle
# uint: degree
/cmd_vel #subscriber
# Type: std_msgs/Float64
# info: used to set the force on gas pedal range from 0~1 (0 for no pressure on gas pedal and 1 for full pressure on gas pedal).
/odom # publisher
# type: nav_msgs/Odometry
# info: used to publish the position of the vehicle
# uint: (position is in meter realtive to the world) (orinetation is quatrion and you must transoform it into euler)
/Imu
# type: sensor_msgs/Imu
# info: used to publish the linear acceleration and angular velocity and angular position of the vehicle
# uint: (linear acceleration is in m/s^2 realtive to the world) (angular velocity is rad/sec)
/velodyne_points
# type: sensor_msgs/PointCloud2
# info: used to publish Lidar points cloud
# uint: of point distance is in meter
```

## ARTICLE 9: Download simulator

To download the simulator find it at EVER academy on Udemy, Autonomous Track, Milestone One.

