

The Rule of 18TH FIRA Roboworld Cup (Malaysia Open) 2025

“Autonomous Car Simulation Challenge: Urban Track”

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TASK

Each team shall consist of 2 students only.

1. Both players of each team **MUST BE PRESENT** at the designated station on time.
2. If a team was **NOT READY AND PRESENT** at the station within **5 minutes** of callout of their turn, the team will forfeit that round.
3. Each team will have 20 minutes and a maximum of 3 tries. **(This is subject to change based on the number of participations in this challenge)**
4. Any violation will result in forfeit for the stage.
5. The Car needs to **race autonomously** to complete the track within a given time.
6. The competition consists of preliminary and final stages.
7. **The Stages**
 - a. Based on the scores obtained in the preliminary stage, some teams will advance to the final stage. **(This is subject to change based on the number of participations in this challenge)**.
 - b. In the final stage, there may be obstacles on the street, **(Subject to change)**
 - c. The scores will be reset to zero in the final stage.
8. After finishing each stage, team leader must confirm the score sheet.

Urban competition



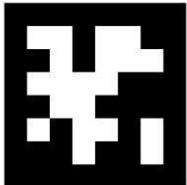

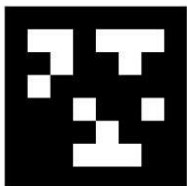



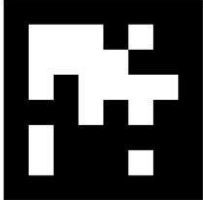

In urban driving competitions, the car must be driven automatically in the urban environment by traffic signs, street lanes, pedestrian lanes, and other environmental information (Figure 3).

The color of street lines in the urban environment is white. There are many checkpoints on the streets. Every wrong car decision will cause you to lose points, described in detail in the scoring model.

In this part of the match, each team has a specific time and can start the match only once. (Before the match starts, teams have a short time to check the execution of their code in the refereeing system)

There are traffic signs and tags (Table 1) at intersections, and failure to identify each and making the wrong decision will result in failure to continue and loss of subsequent checkpoints. The tags will be Apriltag 36h11 family.

At the intersections, there are horizontal lines that indicate reaching the crossroad and the car must stop for at least 3 seconds and then continue moving.

id	Car Decision	Sign Marker	Sign Picture	Sign Name
0	Should not enter the street which has this sign in the beginning of it.			No Entry
1	Should not enter the street which has this sign in the beginning of it.			Dead End
2	Should choose the road on the right of the junction			Proceed Right
3	Should choose the road on the left of the junction.			Proceed Left
4	Should proceed forward.			Proceed Forward

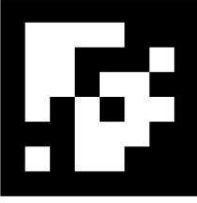

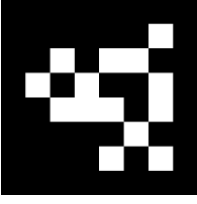

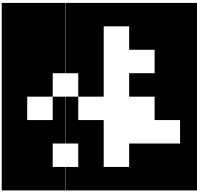
5	Should stop (this is the destination).			Stop
6	The lighting conditions change and the car's headlights have to be turned on.			Start the tunnel
7	End of tunnel and turn off car lights			The end of the tunnel

Table 1: Information about Apriltags in Urban track and what decision should the car make.

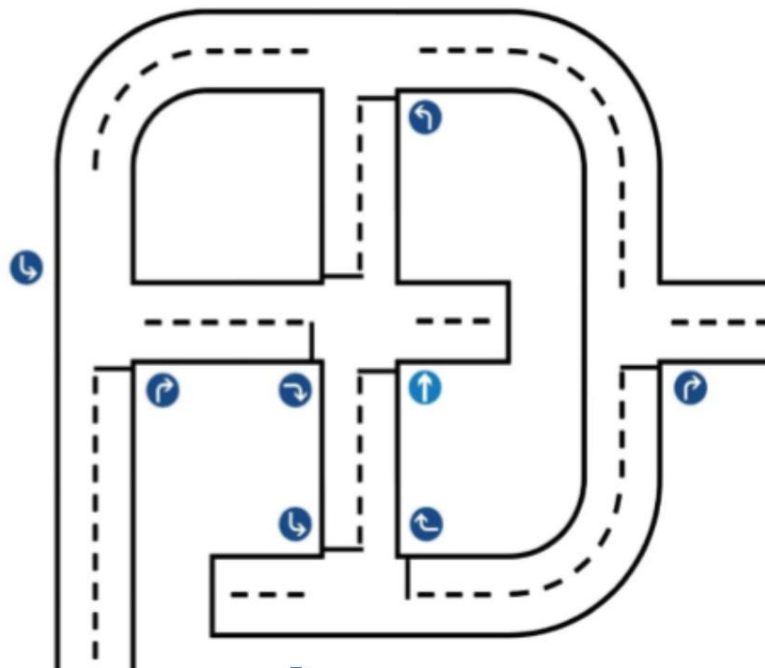


Figure 3: An example of a possible urban environment map.

The car must start by announcing the start of the race of the simulator and stop by following the traffic signs at the destination where the "stop" sign is located. There is at least one checkpoint between the two intersections, and any wrong decision at the crossroads will deduct points, and the car will not be able to continue competing.

The car must move between street lines (in the right lane) unless it exits the right lane to avoid an obstacle. (In the new version of the simulator, to earn checkpoints, the car must be in the correct line)

Depending on the stage, there may be obstacles on the street, and if the car hits them, the competition will end.

Autonomous Urban Driving Scoring Model

In this part, cars have to start from a starting point and navigate in the streets according to the signs and reach the destination point. Each checkpoint reached by car has 60 points. Sum of these points minus the sum of the penalty points each car received during its navigation will be the score of this part. The penalty points table is shown below :

Penalty Definition	Penalty Points
No stop injunction	-10
The incorrect decision injunction	-30
Incorrect lane change (once between two junctions)	-20

$$S_{AUD} = \{60 * (\text{number of checkpoints})\} - (\text{sum of penalty points})$$

If the two teams' scores are the same in this section, the team that finishes in a shorter time will win.

Wrong decisions at the crossroads and choosing the wrong path will be considered as finishing the round.

Notes:

- The scores of each part can not become negative.
- If the car hits an obstacle, the run is considered finished. If the car gets out of the road in an urban environment, it will be considered as a collision with the road barrier and the round will be finished.
- After the judgment of the final stage and determining the top teams, they are required to send the codes and algorithms to the technical committee. After reviewing the codes and algorithms by the technical committee, the final teams will be determined.
- The round ends when the participant notifies the referee that the match is over or the car hits an obstacle.

The determination of the **Master Champion** for this category is based on the highest number of gold medals obtained. If two teams have the same number of gold medals, the Master Champion will be determined using the following formula:

$$S_T = S_{AR} + S_{AUD}$$

provided that the teams have participated in both sub-categories. Any team that does not participate in both sub-categories is **not eligible** for the determination of the Master Champion in this category.

GAME PLAY

1. Only the leader designated for each team will run the code at the assigned station.
2. Teams can open any number of terminals to run their code but cannot start the race until permitted.
3. Stopwatch will be used to take time.
4. Time will start when the leader pressed Enter to execute their python file that will move the Car.
5. The time will stop after the Car crossed the finish line or when the Car hit obstacle (the stage will be considered finished).

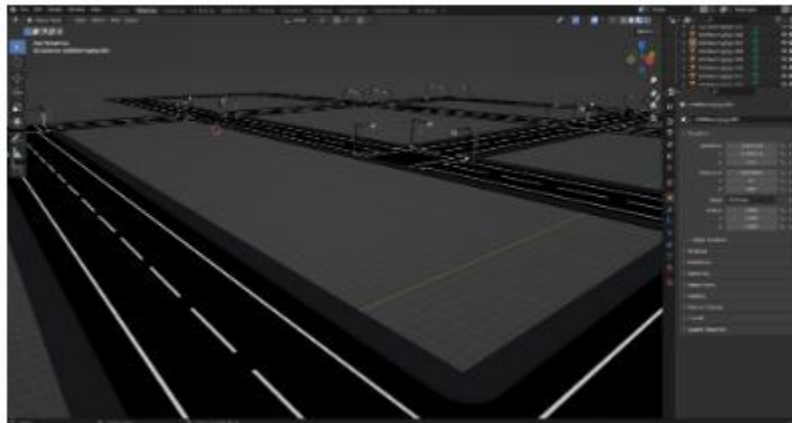


Figure 1: Different views of urban track in gazebo simulator.

SIMULATOR

1. All the processes for car control are being handled by Robot operating system (ROS) and simulating the 3D environment of this challenge is designed and being handled by Gazebo simulator.
2. The simulator is accessible from <https://github.com/Fira-Autonomous-Cars/FIRA-Autonomous-Cars-Simulator> installation instructions will also be available there.
3. Minimum requirement:
 - CPU: Intel® Core™ i5-5257U CPU @ 2.70GHz
 - GPU: Intel® Iris 6100
 - RAM: 8 GB
 - Ubuntu 20.04
 - ROS Noetic
4. Launching the following command will start the gazebo simulator in the racetrack.

```
roslaunch avisengine_environment track_urban_simple.launch
```

5. Participants get the front camera image from `/catvehicle/camera_front/image_raw_front/compressed` topic and must send steering and velocity through `/catvehicle/cmd_vel_safe`
6. The car can also be driven manually by launching the following command:

```
roslaunch catvehicle_tests cmdvel_unsafetest.launch
```

REFERENCES

- ^[1] "Latest Version of this FIRA Official document" [Online]. <https://docs.google.com/document/d/1JIDED3eSy1eIq4Jrc4L8M0LGSziAxxGFpkfxNDrqXAAQ/edit?usp=sharing>
- ^[2] "FIRA Autonomous Cars Github organization profile" [Online]. <https://github.com/Fira-Autonomous-Cars>