RCAP CoSpace Autonomous Driving Challenge Rules 2021
(Former CoSpace Grand Prix)
U19

These are the official rules for CoSpace Autonomous Driving Online Challenge 2021. This rule book is released by the RoboCup Asia-Pacific CoSpace Technical Committee. English rules have priority over any translations. Changes from the 2020 rules are highlighted in red.

PREFACE

The RCAP CoSpace Autonomous Driving Challenge focuses on path planning in a smart city. For this challenge, teams are required to program autonomous vehicles to navigate through a smart city in both real and virtual environments (CoSpace).

The CoSpace Autonomous Driving Simulator is the only official platform for the CoSpace Autonomous Driving Challenge. This simulator allows programs to be developed using a graphical programming interface (GUI), Python or C language. The same program for the virtual robot in the virtual environment can be downloaded on to a real robot in the real environment. Participating teams can contact support@cospacerobot.org for CoSpace Auto-Driving Simulator download, help and assistance.

In the CoSpace Autonomous Driving Online Challenge 2021, students will only need to program the virtual robot and compete in virtual environment.

Figure 1: CoSpace Autonomous Driving Challenge

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Content

CHAPTER 1: GENERAL RULES

1 CoSpace Autonomous Driving Challenge (Online) Description

The RCAP CoSpace Autonomous Driving Challenge (Former CoSpace Grand Prix) focuses on path planning in a smart city. For this challenge, teams are required to program the virtual robot (autonomous vehicle) to navigate through a virtual smart city. The maximum stay in virtual world is 8 minutes.

Video Link: https://youtu.be/pdVMRlEiQwI

Figure 2: CoSpace Autonomous Driving Challenge (online), U19

2 Teams

2.1. Team

2.1.1 A CoSpace Autonomous Driving team should consist of 1 to 2 members. Each participant can only register for one team.

2.1.2 Each team must have a captain. The captain is responsible for communication with officials during the game. If the team only has one member, he/she is the captain of the team.

2.1.3 Teams with all student members aged 13 to 19 year old can participate in this category. If a team has mixed ages (i.e. both U12 and U19 members), they will be allowed to compete in U19 category. Age is as specified on 1st July in the year of the competition.

2.2. Responsibility

2.2.1 The team members are solely responsible for

- verifying the latest version of the rules prior to the competition. If any rule clarification is needed, please contact the CoSpace Technical Committee.
- coding for the virtual robot in the virtual world.
- uploading the correct code to the CoSpace Challenge server.
- communication with CoSpace Technical Committee and Organising Committee for all CoSpace Autonomous Driving Challenge related matters.

3 Referees

3.1. Digital Referee

3.1.1 The virtual challenge will be judged by the CoSpace Autonomous Driving built-in referee system automatically.

3.2. Official

3.2.1 Official from CoSpace Organising Committee will download the code from CoSpace server and run the game. The official will make sure that the CoSpace Autonomous Driving Challenge rules (Online challenge) are followed.

3.2.2 In any case, official will not stop the game unless any unforeseen situation appears. Official will communicate with the teams to explain the action taken in case any interruption is carried out.

4 Conflict Resolution

4.1. Official

4.1.1 During the CoSpace Autonomous Driving challenge, the officials' decisions are final.

4.2. Rule Clarification

4.2.1 If necessary, a rule clarification may be made by an official from the CoSpace Technical Committee and Organizing Committee, even during a tournament.

5 Documentation

5.1. Team Description Paper (TDP) and Technical Demonstration Video

5.1.1 Each team is required to submit a TDP and Technical Demonstration Video prior to the challenge day (details should announced by the Technical Committee).

6 Code of Conduct

6.1. Fair Play

6.1.1 CoSpace Autonomous Driving Challenge is built upon the foundation of fairness, respect and friendship.

6.1.2 Mentors (teachers, parents, chaperones, translators, and other adult members) are not allowed to be involved in the programming of students' robots or perform other assistance work.

6.2. Penalty

6.2.1 The following are strictly prohibited.

(a) During the game, using third-party software, self-written code, or any other tools to retrieve additional system information is strictly prohibited.

6.3. Sharing

6.3.1 Teams are encouraged to share their codes and strategies with members after the competition.

6.3.2 Any developments may be published on the RCAP Academy Channel or CoSpaceRobot.org after the event.

6.3.3 RCAP CoSpace Autonomous Driving sharing furthers the mission of RoboCup Asia Pacific as an educational initiative.

6.4. Spirit

6.4.1 It is expected that all participants (students and mentors alike) will respect the RoboCup Asia Pacific mission.

6.4.2 It is not whether you win or lose, but how much you learn that counts!

CHAPTER 2: FIELDS AND ROBOTS

7 Virtual Field

7.1. VIRTUAL_WORLD Dimension

7.1.1 The dimensions of VIRTUAL_WORLD will be less than 600cm x 450cm.

7.1.2 Any surface colour that does not distract the robot's detection or movement is allowed.

7.2. VIRTUAL_WORLD Layout

7.2.1 The VIRTUAL_WORLD may consist any of black/white guidelines, obstacles, gantries, waypoints, detour markers, and mysterious tasks.

7.2.2 Black/White Guidelines

- There will be black line on light road or white guideline on dark road.
- The black/white guideline forms a path to guide the virtual robot.
- Straight sections of the black/white guideline may have gaps with at least 5 cm of straight line before each gap. The length of a gap will be no more than 20 cm.

Figure 3: Black / white guideline

7.2.3   Obstacles

The virtual obstacles can be walls, buildings, cylinders, or cubes. The size, design and colour of obstacles can be varied.

7.2.4   Gantries

Gantry is an overhead assembly on which certain signs or signals are posted. Gantry will not block the road. The design and colour of gantries can be varied.

Figure 4: Example of a gantry

7.2.5   Waypoints

The virtual robot needs to pass all waypoints in the virtual environment. The size of waypoint is not fixed. It is orange in colour.

Figure 5：Waypoint

7.2.6   Detour Markers

There are some colour markers in virtual VIRTUAL_WORLD to help robots to make decision at junctions. The marker can be of any colour.

Figure 6: Detour markers

7.2.7   Termination Markers

This is the terminal point of the Black/White guideline.

Figure 7: Termination marker

7.2.8   Finish Lines

The mission is completed when VIRTUAL_ROBOT passes the finish line. The finish line will be indicated by the following symbols.

Figure 8: Finish Line

8 Virtual Robot

8.1. VIRTUAL_ROBOT Configuration
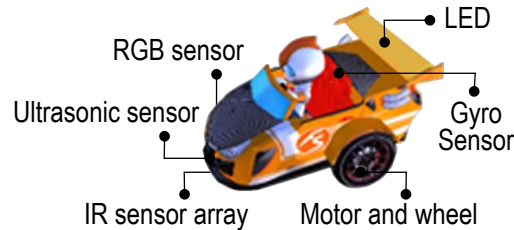
8.1.1 The VIRTUAL_ROBOT configuration is as follows:

Figure 9: Virtual robot

8.2. Robot Coding

8.2.1 Teams can use GUI, Python or C to program the virtual robot to complete the task.

CHAPTER 3: GAMEPLAY AND JUDGING

9 Gameplay

9.1. Release of Task

9.1.1 The tasks will be released to teams online. The organiser will inform teams about the detailed arrangement prior to the game.

9.2. Submission of AI

9.2.1 Teams must submit code to the CoSpace online server at the end of coding session. The sever accepts multiple submissions. However, only the last code submitted will be accepted. The CoSpace online server will be closed 10 min after the end of coding session.

9.3. Virtual Game

9.3.1 It is the teams' responsibility to ensure that the correct code is submitted.

9.3.2 The official will download the program and upload it onto the VIRTUAL_ROBOT. The VIRTUAL ROBOT will then be placed at the "Start" station in the VIRTUAL_WORLD.

9.3.3 VIRTUAL_ROBOT is required to pass all waypoints or gantries successfully in any order. VIRTUAL_ROBOT is required to stop at each waypoint with LED flashing for 2 seconds. The VIRTUAL_ROBOT must move away automatically afterwards.

9.3.4 The VIRTUAL_ROBOT should avoid all obstacles.

9.3.5 Teams are encouraged to make use of Detour Markers to plan the best path.

9.3.6 When VIRTUAL_ROBOT reaches the "Finish" line, the game ends.

9.3.7 The maximum time for VIRTUAL_ROBOT to stay in VIRTUAL_WORLD is 8 minutes.

9.4. Ranking

The teams are ranked as follows:

	Situation	Rank
Tier 1	• VIRTUAL_ROBOT passes all waypoints and reaches the finish line.	• The team rank is determined by the game time at the finish line in the VIRTUAL_WORLD.
Tier 2	• VIRTUAL_ROBOT is not able to passes all waypoints (regardless whether it reaches the finish line or not)	• The race time for VIRTUAL_ROBOT to reach the last waypoint will be recorded. • The team rank will be determined based on the number of waypoints passed followed by the game time.

10   Judging and Award

10.1. Judging

10.1.1   There will be 2 round of challenges – preliminary and final.

10.1.2   Teams will be judged based on TDP, video presentation and the prelim result. Teams have passed the assessment criteria will enter the finals.

10.2. Awards

The organising committee will announce the awards.

RCAP CoSpace Technical Committee

Contact us:

Rule clarification: cospace@robocupap.org
Technical support: support@CoSpaceRobot.org