

# RCAP CoSpace Autonomous Driving Challenge Rules 2026

## FirstSteps, U12

These are the official rules for CoSpace Autonomous Driving Challenge 2026.

### 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 virtual environments.

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. Participating teams can contact [support@cospacerobot.org](mailto:support@cospacerobot.org) for CoSpace Auto-Driving Simulator download, help and assistance.

In the CoSpace Autonomous Driving, FirstSteps U12 category, students will compete in VIRTUAL\_WORLD only.



Figure 1: CoSpace Auto-driving Challenge

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## CHAPTER 1: GENERAL RULES

### 1 CoSpace Autonomous Driving Challenge Description

The RCAP CoSpace Autonomous Driving Challenge focuses on autonomous path planning in a smart city environment. Teams are required to program a virtual robot to navigate the designated environment and subsequently participate in the Autonomous Driving Challenge in the VIRTUAL\_WORLD.

Duration of the challenge: 4 minutes

### 2 Team

#### 2.1 Team Members

- 2.1.1 Teams must comprise **2 to 4 members**. Dual registration is strictly prohibited.
- 2.1.2 Each team must designate a **Captain** as the sole liaison to referees during matches.
- 2.1.3 **FirstSteps U12 Category:** All team members must be aged 7 to 12 on **July 1** of the competition year.

#### 2.2 Responsibility

- 2.2.1 Teams must track official rule updates, announcements, and schedules throughout the tournament.
- 2.2.2 Teams are responsible for programming and deploying verified code.
- 2.2.3 Technical and administrative inquiries must be directed exclusively through the Technical Committee (TC) and Organizing Committee (OC).

### 3 Referees

#### 3.1 Official

- 3.1.1 A referee is an official who manages the CoSpace Auto-driving Challenge and makes sure that the CoSpace Auto-driving rules are followed.
- 3.1.2 The referee receives and uploads the teams' virtual programs, as well as running the game.

### 4 Human Interference

- 4.1.1 **Restrictions:** Unprompted human interference during an active run is strictly forbidden.
- 4.1.2 **Communication:** Only the Team Captain is permitted to communicate with match officials during play.

### 5 Game Interruption

- 5.1.1 In principle, a matches proceed without interruption. A referee may pause an active match only when consulting the TC or OC on technical or procedural matters.

## **6 Conflict Resolution**

### **6.1. Referee**

- 6.1.1 During the CoSpace Auto-driving challenge, the referee's decisions are final.
- 6.1.2 At the conclusion of a game, the referee will ask the captain to sign the CoSpace Auto-driving result sheet. Captains are given a maximum of 1 minute to review the result and sign. By signing it, the captain accepts the result on behalf of the entire team. In case of further clarification, the team captain should write their comments on the result sheet and sign it.
- 6.1.3 A violation of the rules may result in disqualification from the tournament or the round at the discretion of the referee, officials, organizing committee and general chairs.
- 6.1.4 In case the team refuses to sign the scoresheet after the game, they should be advised to file a complaint following the procedure in section 6.4. This should not interrupt the following games. The referee should follow the instruction given by the chief judge.

### **6.2 Rule Clarification**

- 6.2.1 It is the team's responsibility to verify on the official website the latest version of the rules prior to the competition. If any rule clarification is needed, please contact the CoSpace Technical Committee.
- 6.2.2 If necessary, a rule clarification may be made by members of the CoSpace Technical Committee and Organizing Committee, even during a tournament.

### **6.3 Special Circumstances**

- 6.3.1 Under special circumstances, such as the occurrence of unforeseen problems or malfunctions of the robot, rules may be modified by the Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, if necessary, even during a tournament.
- 6.3.2 If any of the team captains/members/mentors do not show up to the team meetings to discuss the problems and the resulting rule modifications described in 6.3.1, it will be considered as an endorsement.

### **6.4 Complaint Procedure**

- 6.4.1 Rule issues are not to be discussed during the run. Referee decisions are binding for the CoSpace Auto-driving challenge. A team may protest by executing the following complaint procedure. The procedure is automatically invoked if a referee decides to abort the run for any reason (e.g. field damage, lighting failures, burning robots).
- 6.4.2 To initiate the complaint procedure, the team leader of the challenging team has to contact a member of the Technical Committee within 10 minutes of the end of the run. The member of the Technical Committee will then invoke a team leader conference in consultation with the Organizing Committee. The following parties will participate in this conference: the referees of the run, Organising Committee members, and the Technical Committee (counselling). The situation shall be resolved by unanimous consent or by vote of the Organising Committee members. The chief charge should inform the referee concern about the final decisions.

- 6.4.3 All teams are reminded that while this is a competition, the league is also about cooperative research and evaluation, as such, complaints should be handled in a fair and forthcoming way.

## **7 Documentation**

### **7.1 My First RoboCup Journey**

- 7.1.1 Teams are required to submit the document – My first robocup journey prior to the event.

## **8 Code of Conduct and Penalties**

### **8.1 Fair Play and Integrity**

- 8.1.1 The competition is grounded in mutual respect, sportsmanship, and fair play.
- 8.1.2 Mentors, coaches, educators, translators, and parents are strictly barred from the student pit area and may neither code nor configure student robots during the event.

### **8.2 Disciplinary Actions (Yellow & Red Cards)**

- 8.2.1 **Compliance & Accountability:** Prior to the challenge, team leaders and mentors must sign an acknowledgment confirming that they have read, understood, and agreed to adhere to the official rules and Code of Conduct. All participants are fully accountable for their actions.
- 8.2.2 **Authority & Progression:** Participants must strictly follow referee directives during matches. Failure to comply will result in a **Warning (Yellow Card)**. A subsequent infraction leads to an automatic **Disqualification (Red Card)** for that round. Disqualifications resulting from deliberate disruptions are final and non-appealable. All cards issued are formally tracked throughout the tournament.

#### **8.2.3 Yellow Card (Warning) Procedure**

- A Yellow Card is issued at the discretion of the Lead Referee, provided no objections are raised during mandatory consultation with the Assistant Referee.
- A WARNING will be issued for the following disruptive behaviours and activities including but not limited to:
  - (a) Disobeying referee instructions.
  - (b) Obstructing participants, tournament staff, or referees.
  - (c) Shouting, shouting-adjacent behavior, profanity, or offensive vocalizations.
  - (d) Damaging or sabotaging another team's equipment or personal property.
  - (e) Unauthorized entry into the competition field while matches are active.
  - (f) Unauthorized entry into another team's designated pit area.
  - (g) Disorderly conduct, running, rough play, or physical altercations.
  - (h) Harassing or arguing with referees.
  - (i) Direct mentor interference with robots, students, or referee decisions.

#### **8.2.4 Red Card (Disqualification) Procedure**

- A Red Card may be issued by the Lead Referee after consulting the Assistant Referee. An immediate Red Card requires joint agreement between the Lead and Assistant Referees.
- A Red Card will be issued for the following cases:
  - (a) Accumulating two (2) Yellow Cards across the competition period (spanning the event opening through closing ceremonies).
  - (b) Deliberately interfering with physical robots or damaging arena infrastructure.
  - (c) Code plagiarism or unauthorized code sharing—both the donor and recipient teams will be disqualified.

#### 8.2.5 Escalation of Red Card Penalties:

- A first Red Card immediately disqualifies the team from their current run.
- A second Red Card results in complete expulsion from the tournament.

#### 8.2.6 Formal Review & Extended Sanctions:

All immediate disqualifications are subject to review by the Chief Judge and the Organizing Committee. Severe infractions will be evaluated for further disciplinary measures, including formal bans from future RCAP events.

### 8.3 Software Integrity & System Penalties

#### 8.3.1 The following system-level manipulations are strictly prohibited:

- (a) Deploying background tools, third-party hooks, or custom code to extract unauthorized telemetry or memory data from the simulation.
- (b) Interfering with the RCAP CoSpace Simulator environment (e.g., resizing or scaling windows, manipulating thread execution, or tampering with rendering).

#### 8.3.2 Sanctions:

- First Offense: Forfeit/disqualification from the current match (issued by Chief Judge / TC).
- Repeat Offense: Immediate expulsion from the competition.

### 8.4 Knowledge Sharing

#### 8.4.1 Post-tournament sharing of strategies, source code, and algorithms is strongly encouraged.

#### 8.4.2 Selected solutions and technical frameworks may be archived and published via RCAP Academy and CoSpaceRobot.org to advance collaborative robotics research.

#### 8.4.3 Above all, participants and mentors are expected to uphold the educational spirit of RoboCup: *the depth of knowledge acquired holds greater value than winning or losing.*

## CHAPTER 2: FIELDS

### 9 VIRTUAL\_WORLD

#### 9.1 VIRTUAL\_WORLD Layout

9.1.1 The VIRTUAL\_WORLD may incorporate black/white guidelines, static obstacles, gantries, waypoints, detour markers, termination markers, and unannounced mystery tasks. Ground texture colors are chosen to prevent false-positive sensor readings or unintended vehicle interference.

#### 9.1.2 Black/White Guidelines

- Black/white guidelines feature high contrast: dark lines on light terrain or light lines on dark terrain.
- Guidelines define the designated driving path for the VIRTUAL\_ROBOT.
- Straight segments may contain path discontinuities (gaps) up to 20 cm in length. Each gap is preceded by a continuous line segment of at least 5 cm.



Figure 2: Black / white guideline

9.1.3 **Virtual Obstacles:** Obstacles may include walls, buildings, cylinders, or cubes, featuring diverse dimensions, colours, and textures.

9.1.4 **Gantries:** Gantries are elevated structures spanning the roadway displaying signs, warnings, or signals. Gantries provide adequate clearance and will not physically impede robot navigation. Visual designs and colour schemes may vary.



Figure 3: Example of a gantry

9.1.5 **Waypoints:** The VIRTUAL\_ROBOT must traverse all designated waypoints within the virtual map. Waypoints vary in size and are marked in orange.



Figure 4: Waypoint

9.2.6 **Detour Markers:** Distinctly coloured navigational patches are positioned before road junctions to aid decision-making and route selection. Marker colors may vary depending on the specific track design.



Figure 5: Sample of detour markers

9.2.7 **Termination Markers:** Coloured terminal patches define the end of an active navigation guideline.



Figure 6: Termination marker

9.2.8 **Finish Line:** The virtual mission concludes when the VIRTUAL\_ROBOT fully crosses the designated finish line, marked by explicit visual indicators on the track.

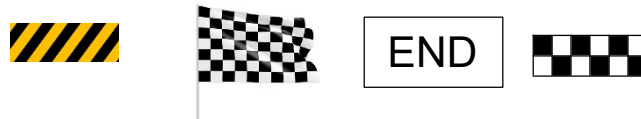


Figure 7: Finish Line

Typical VIRTUAL\_WORLD layout:



Figure 8: VIRTUAL\_WORLD Layout

## CHAPTER 3: ROBOT

### 10 VIRTUAL\_ROBOT

#### 10.1 VIRTUAL\_ROBOT Configuration

10.1.1 The VIRTUAL\_ROBOT operates under the following standardized virtual specifications:

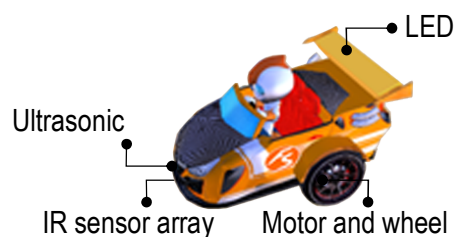


Figure 9: Virtual robot

## 10.2 Coding for VIRTUAL\_ROBOT

10.2.1 **Supported Languages:** Teams may develop software for the VIRTUAL\_ROBOT using GUI-based tools, Python, or standard C to navigate and complete tasks within the VIRTUAL\_WORLD.

# CHAPTER 4: GAMEPLAY, JUDGING AND AWARD

## 11 Gameplay Procedure

### 11.1 Task Announcement

11.1.1 The Organizing Committee will announce the official tasks in the main competition arena.

### 11.2 First AI Submission (AI\_1)

11.2.1 **Deadline:** The Chief Judge will announce the strict submission deadline for the first program (AI\_1) in the competition hall.

11.2.2 **Mandate:** Every team must submit the AI\_1 code developed during the official coding session directly to the Chief Judge.

### 11.3 Match Initialization & Progression

11.3.1 **Check-in:** Team Captains must report to the referee at their assigned station **five (5) minutes** prior to their scheduled run.

11.3.2 **Round 1 Execution:** Run 1 must execute using AI\_1. Re-submissions or modifications to AI\_1 are not permitted.

11.3.3 **Iterative AI Re-submission:** From Run 2 onward, teams may submit a revised AI version to the referee no later than **five (5) minutes** before the scheduled start time.

11.3.4 **Default Codebase:** If no revised program is submitted at the 5-minute mark, the referee will deploy the most recently active version. The referee must confirm the active version with the Team Captain before starting the match.

11.3.5 **Lockout:** No program adjustments or uploads are permitted once a match begins.

### 11.5 Run Procedures

11.5.1 **Deployment:** The referee uploads the verified virtual program to the CoSpace Platform and initializes the VIRTUAL\_ROBOT in the starting area.

11.5.2 **Verification:** The Team Captain must ensure the referee deploys the correct program file.

11.5.3 **Presence:** The Team Captain must remain at the station throughout the virtual run.

11.5.4 **Waypoints & Gantries:** The VIRTUAL\_ROBOT must traverse all waypoints and clear all overhead gantries in any order. The robot is not required to halt at waypoints.

11.5.5 **Obstacle Avoidance:** Collision-free navigation around all virtual obstacles is mandatory.

11.5.6 **Detour Markers:** Teams are encouraged to detect detour markers at intersections for optimal path selection.

11.5.7 **Match Termination:** The virtual run terminates immediately when the VIRTUAL\_ROBOT crosses the designated FINISH line.

## CHAPTER 5: RANKING RULES AND AWARDS

### 12 Ranking Rules

#### 12.1 Competition Maps & Rounds

12.1.1 **Structure:** The tournament encompasses multiple distinct maps. Multiple competitive rounds may be held on each individual map.

#### 12.2 Round Ranking Protocol

12.2.1 **Criteria:** Teams will be evaluated and ranked per round according to the following hierarchy:

|        | Situation                                                                                                                                    | Rank                                                                                                                                                                                                                                                                               |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tier 1 | <ul style="list-style-type: none"> <li>The robot successfully clears all waypoints and crosses the Finish Line.</li> </ul>                   | <ul style="list-style-type: none"> <li>The team's rank is determined strictly by the elapsed <b>race time recorded at the Finish Line</b> (fastest time ranks highest).</li> </ul>                                                                                                 |
| Tier 2 | <ul style="list-style-type: none"> <li>The robot fails to clear all waypoints (regardless of whether the Finish Line is reached).</li> </ul> | <ul style="list-style-type: none"> <li>The elapsed race time is logged when the VIRTUAL_ROBOT clears its final successful waypoint.</li> <li>Rankings are determined primarily by the total number of waypoints cleared, with ties broken by the recorded elapsed time.</li> </ul> |

#### 12.3 Map Ranking

12.3.1 **Scoring & Ranking:** A team's score for an individual map is determined solely by their single best round performance on that layout. Teams are then ranked based on these top single-round scores.

12.3.2 **Tie-Breaker:** In the event of a tie in best-round scores, the teams' second-best round scores on that map will serve as the tie-breaker.

#### 12.4 Overall Competition Ranking

12.4.1 **Final Standings:** A team's cumulative tournament score is calculated as the sum of their final rank placements across all completed maps. The team with the lowest cumulative score wins the overall competition.

12.4.2 **Final Tie-Breaker:** If two or more teams finish with identical total scores, overall placement will be determined by their relative rank on the final competition map.

## 13 Awards

- 13.1.1 **Distribution & Formats:** Awards (including trophies and certificates) will be presented based on total team enrollment. The Organizing Committee reserves the authority to adjust award categories and formats as necessary.

RCAP CoSpace Technical Committee

### Contact us:

Rule clarification: [cospace@robocupap.org](mailto:cospace@robocupap.org)

Technical support: [support@CoSpaceRobot.org](mailto:support@CoSpaceRobot.org)