



RCAP CoSpace Grand Prix Rules 2017 (CoSpace F1)

This document contains the official rules for the RoboCup Asia Pacific (RCAP) 2017 CoSpace Grand Prix Challenge. They are released by the RoboCup Asia Pacific CoSpace Grand Prix Technical Committee. The English rules have priority over any translations.

PREFACE

The RCAP CoSpace Grand Prix Challenge is a new educational initiative to interest, excite and engage participants on STEM and Computational Thinking through tinkering, making and coding in both virtual and real environments (CoSpace). In the CoSpace Grand Prix Challenge, students need to make a robot, code a robot, and finally take part in the Grand Prix challenge in CoSpace.

The CoSpace F1 Simulator is the only official platform for the CoSpace Grand Prix Challenge. This simulator allows programs to be developed using a graphical programming interface (GUI) or C language. The same program for the virtual robot in the virtual environment can be downloaded onto real robot in the real environment. Participation teams can contact support@cospacerobot.org for CoSpace F1 Simulator download, help and assistance.



Figure 1: CoSpace Grand Prix Challenge



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CHAPTER 1: GENERAL RULES

1 Team

1.1. Team Members

- 1.1.1 A team should have more than one member to form a CoSpace Grand Prix team to participate in the Regional or Super-Regional event. Each participant can only register for one team.
- 1.1.2 All team members must be at the right age for the respective age group.
- Primary category: all members of a primary team have to be between 9 to 14 years old.
 - Secondary category: members of a secondary team have to be between 15 to 19 years old. If a team has mixed ages (i.e. both primary and secondary aged members), they will be allowed to compete in secondary category.
 - Age is specified as on 1st July in the year of the competition.
- 1.1.3 Every team member need to carry out a technical role for the team (strategy planning, programming, etc.), which should be identified at the registration. Each member will need to explain his/her technical role and should be prepared to answer questions on the technical aspects of their involvement in preparing the CoSpace Grand Prix Challenge.
- 1.1.4 Teams should be responsible for checking updated information (schedules, meetings, announcements, etc.) during the event.

1.2. Team Captain

- 1.2.1 Each team must have a captain. The captain is the person responsible for communication with referees during the game.
- 1.2.2 As the space around the competition fields is limited (and crowds can often result in accidents that damage the robots), only team captain is allowed to operate the real robot, based on the stated rules and as directed by the referee. Other team members (and any spectators) within the vicinity of the real world are to stand at least 150 cm away from the real world while their real robot is active, unless otherwise directed by the referee.

2 CoSpace Grand Prix Description

In the CoSpace Grand Prix Challenge, students need to make a robot, code a robot, and finally take part in the Grand Prix challenge in CoSpace.

2.1 Make a Robot

- 2.1.1 Teams are required to assemble a real robot using the standard robot maker kit. Teams may need to design and make additional accessories to accomplish the mission.

2.2 Code a Robot

- 2.2.1 There are two types of robots used in the Grand Prix challenge. A team must program the real robot (ROBOT_1) in the real world (WORLD_1) and the virtual robot (ROBOT_2) in the virtual world (WORLD_2) to complete the Grand Prix mission.

2.3 Grand Challenge

- 2.3.1 The CoSpace Grand Prix grand challenge consists of race in WORLD_1 and WORLD_2. The maximum duration for the Grand Prix grand challenge is 8 minutes.
- 2.3.2 A challenge begins with ROBOT_1 racing in WORLD_1 while ROBOT_2 is on standby in WORLD_2. When ROBOT_1 passes the “REF_TELE” gate of the referee box (refer to section 3.2), ROBOT_2 will be activated (Teleportation) to race in WORLD_2 and ROBOT_1 stops until the end of the race.

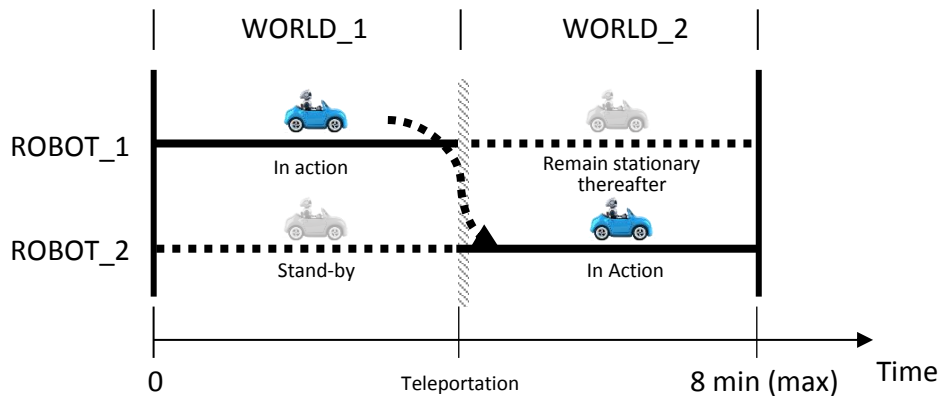


Figure 2: CoSpace Grand Prix process

3 Referee

3.1. Official

- 3.1.1 A referee is an official who manages the CoSpace Grand Prix and makes sure that the CoSpace Grand Prix rules are followed.
- 3.1.2 Referee receives and uploads teams’ virtual programs as well as runs the race.

3.2. The Referee Box

- 3.2.1 The organiser will provide a Referee Box that acts as the digital referee for race in WORLD_1. It communicates with the CoSpace server throughout the whole competition. The referee box consists “REF_STAT” gate and “REF_TELE” gate.
- 3.2.2 Once the ROBOT_1 passes the “REF_STAT”, the game clock begins. The team’s ROBOT_2 will be activated and the virtual race will be started once the ROBOT_1 passes the “REF_TELE”. It is organiser’s responsibility to ensure the referee box is in good working condition.

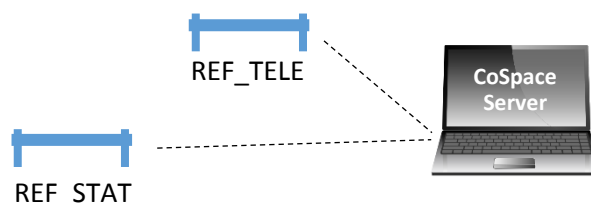


Figure 3: Referee Box

4 Human Interference

- 4.1.1 Except for resetting ROBOT_1 as permitted by the referee, human interference during the race is not allowed.



- 4.1.2 In any case, only the team captain is allowed to communicate with the referee.

5 Penalty

- 5.1.1 It is compulsory for teams to specify the team name in virtual race. Teams will be given a verbal warning if they failed to do so for the first time. The team will be disqualified for the current race if the team fails to add the team name for the second time in a virtual race.

6 Interruption of a Race

- 6.1.1 In principle, a race will not be stopped during the challenge unless referee needs to discuss an issue/problem with the OC/TC.

7 Conflict Resolution

7.1. Referee

- 7.1.1 During the CoSpace Grand Prix, the referee's decisions are final.
- 7.1.2 At the conclusion of a race, the referee will ask the captain to sign the CoSpace Grand Prix result sheet. Captain should be given maximum 1 minute to review the result and sign. By signing it, the captain accepts the final result on behalf of the entire team; in case of further clarification, the team captain should write their comments in the result sheet and sign it.
- 7.1.3 A violation of the rules may be penalized by disqualification from the tournament or the round at the discretion of the referee, officials, organizing committee or general chairs.

7.2. Rule Clarification

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

7.3. Special Circumstances

- 7.3.1 If special circumstances, such as the occurrence of unforeseen problems or malfunctions of robot, rules may be modified by the Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, even during a tournament if necessary.
- 7.3.2 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 at 7.3.1, it will be considered as an endorsement.



7.4. Complaint Procedure

- 7.4.1 Rule issues are not to be discussed during the race. Referee decisions are binding for the CoSpace Grand Prix challenge. A team may protest by executing the following complaint procedure. The procedure is also automatically invoked if a referee decides to abort the race for any reason (e.g. field damage, lighting failures, burning robots).
- 7.4.2 To initiate the complaint procedure, the team leader of the challenging team has to contact a member of the Technical Committee within 10 minutes after the respective race has ended. The member of the Technical Committee will then invoke a team leader conference in consultation with the Organizing Committee. In this conference, the following parties will participate: the referees of the race in question, Organising Committee members, and the Technical Committee (counselling). The situation shall be resolved by unanimous consent or by vote of the Organising Committee members.
- 7.4.3 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.

8 Documentation

8.1. Poster

- 8.1.1 Teams will be given some public space to display their poster. The size of the poster should be no larger than A1 (60 x 84 cm). The poster should be brought along to the technical interview. After the interview the poster should be displayed in the location indicated.

The aim of the poster is to explain the technology used in the robots. It should include:

- Team name;
- Team members' names and (perhaps) a picture of the team members;
- Team's country and location within country;
- Team's school and district;
- What the team hopes to achieve in robotics.

9 Code of Conduct

9.1 Fair Play

- 9.1.1 Humans that cause a deliberate interference with real robots or damage to the real-world setup will be disqualified.
- 9.1.2 It is expected that the aim of all teams is to participate fairly.

9.2 Behaviour

- 9.2.1 If one team copies a program from another team, both teams will be disqualified.
- 9.2.2 Team members should be mindful of other people and their robots when moving around the tournament venue.
- 9.2.3 Team members are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by team members.



- 9.2.4 Team members who misbehave may be asked to leave the building and risk being disqualified from the tournament.
- 9.2.5 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.
- 9.2.6 Mentors (teachers, parents, chaperones, translators, and other adult team members) are not allowed in the student work area. They are not allowed to be involved in the programming of students' robots. Mentor interference with robots or referee decisions will result in a warning in the first instance. If it reoccurs, the team will risk being disqualified.

9.3 Sharing

- 9.3.1 Teams are encouraged to share their programming and strategies to the members from other teams.
- 9.3.2 Any developments may be published on the CoSpace Robot website after the event.
- 9.3.3 RCAP CoSpace Grand Prix sharing furthers the mission of RoboCup Asia Pacific as an educational initiative.

9.4 Spirit

- 9.4.1 It is expected that all participants (students and mentors alike) will respect the RoboCup Asia Pacific mission.
- 9.4.2 The referees and officials will act within the spirit of the event.
- 9.4.3 It is not whether you win or lose, but how much you learn that counts!

CHAPTER 2: FIELDS

10 Real Field (WORLD_1)

10.1 WORLD_1 Dimension

- 10.1.1 The dimensions of WORLD_1 are 200cm x 300cm.
- 10.1.2 The floor may be either smooth or textured and may have steps and/or gap of up to 3 mm. It can also be printed on a canvas.

10.1.3 The WORLD_1 will be placed so that the floor is level.

Typical WORLD_1 layout:

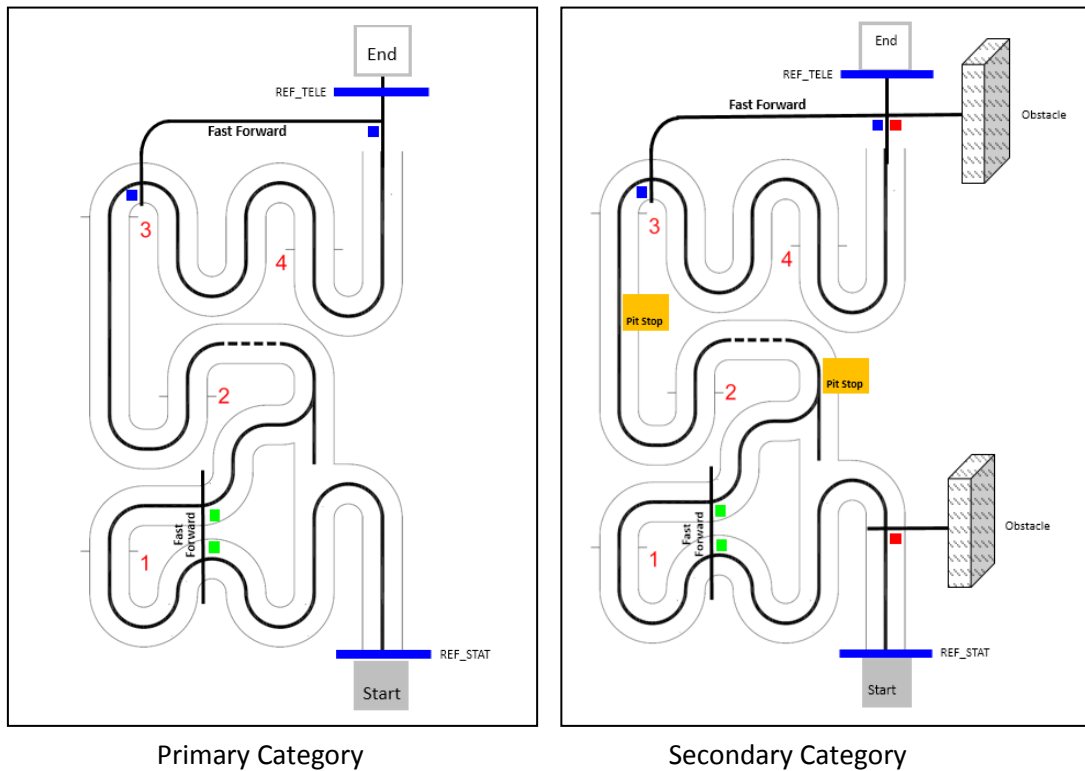


Figure 4: WORLD_1 layout

10.2 WORLD_1 Layout

10.2.1 The WORLD_1 may consists any of the following:

- Primary category:
 - Black Guidelines
 - Detour Markers (RCAP Finals only)
 - Mysterious Tasks
- Secondary category:
 - Black Guidelines
 - Ramps/Bridges
 - Obstacles (RCAP Finals only)
 - Pit Stops (RCAP Finals only)
 - Detour Markers (RCAP Finals only)
 - Mysterious Tasks

10.2.2 Black Guidelines

- The black guideline, 1-2 cm wide, may be made with standard electrical insulating tape or printed onto other materials.
- The black guideline forms a path to guide ROBOT_1 during the race in WORLD_1.
- Straight sections of the black 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 5: Sample of black



10.2.3 Ramps/Bridges

There could be ramps/bridges to allow the robots to “climb” up to and down from different levels. Ramps will not exceed an incline of 25 degrees from the horizontal.

10.2.4 Obstacles

The size of obstacles should not be less than 10 cm x 5 cm x 15 cm (Length x width x height); there is no upper bound on the size. The weight of the obstacles are not specified. Examples of obstacles are trash bins, boxes, big aluminium profiles, etc. ROBOT_1 is expected not to bump into the obstacles.

10.2.5 Pit Stops

In motorsports, a pit stop is where a racing vehicle stops in the pits during a race for refuelling, new tyres, repairs, mechanical adjustments, a driver change, as a penalty, or any combination of the above.

The size of pit stop is not fixed. It is orange colour.



Figure 6: Pit Stop

10.2.6 Detour Markers

There are some colour markers in WORLD_1 to help teams to make decision. The size of the detour marker is greater than 4cm x 4cm. The marker can be any colour. Teams need to make decision whether the ROBOT_1 should move forward, turn left or turn right based on the colour of the detour marker on the real field. The marker colour will only be released on the competition day.



Figure 7: Sample of detour markers

10.2.7 Mysterious Tasks

In WORLD_1, there may be some mysterious tasks. It will only be released on the competition day.

10.3 Environmental Conditions

10.3.1 The environmental conditions at a tournament will be different from the conditions at home. Teams must come prepared to adjust their robots to the conditions at the venue.

10.3.2 Lighting and magnetic conditions may vary in the CoSpace Grand Prix race field.

10.3.3 The field may be affected by unexpected lighting interference (e.g. such as camera flash from spectators). Teams should prepare their robots to handle such interference. Organizers and referees will do their best to minimize external lighting interference.

11 Virtual Field (WORLD_2)

11.1 WORLD_2 Dimension

11.1.1 The dimensions of WORLD_2 are 270cm x 360cm.

11.1.2 Any surface colour, which does not distract robot's detection and movement, is allowed.

Typical WORLD_2 layout:

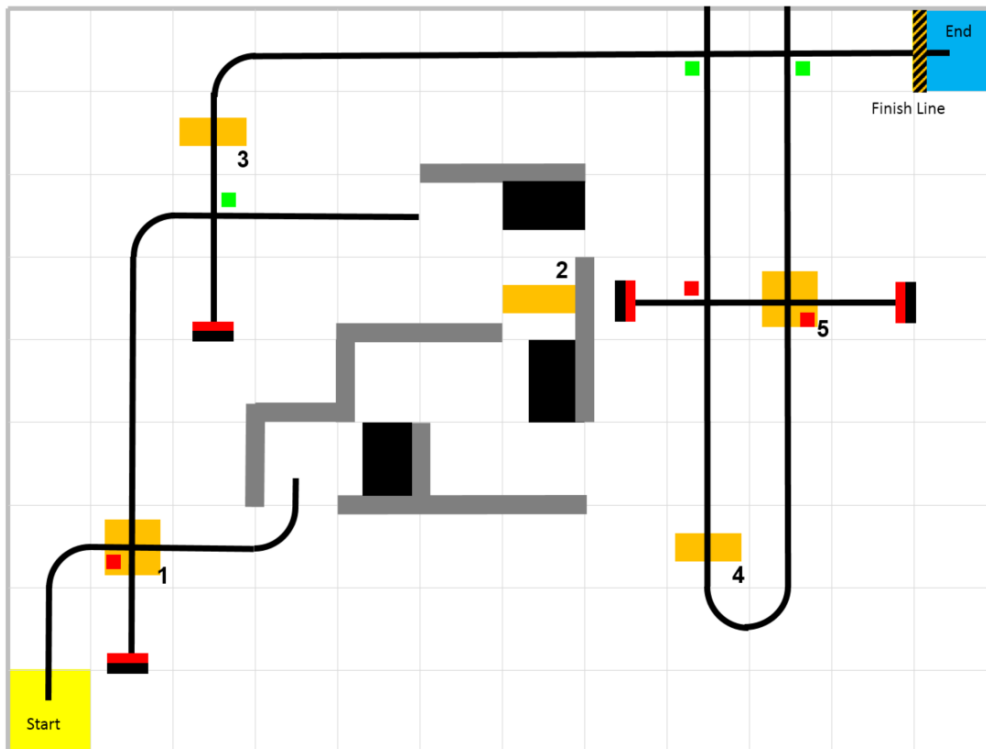


Figure 8: WORLD_2 Layout

11.2 WORLD_2 Layout

11.2.1 The WORLD_2 may consists any of the following:

- Primary category:
 - Black Guidelines
 - Detour Markers (RCAP Finals only)
 - Mysterious Tasks
- Secondary category:
 - Black Guidelines
 - Ramps/Bridges
 - Obstacles (RCAP Finals only)
 - Pit Stops
 - Detour Markers
 - Mysterious Tasks

11.2.2 Black Guideline, Obstacles, Pit Stops, Detour Markers

The specifications of black guideline, obstacles, pit stops, detour markers are the same as they are in WORLD_1, please refer to section 10.2 for details.



11.2.3 End Markers

The end marker is as shown in figure 9. This is the terminal point of the black guideline.



Figure 9: End Marker

11.2.4 Finish Lines

The mission is completed when ROBOT_2 passes the finish line.

CHAPTER 3: ROBOT

12 Real Robot (ROBOT_1)

12.1 ROBOT_1 Construction

12.1.1 The basic design of the ROBOT_1 consists of a battery holder, a chassis, motors, electronics, controllers and sensors. Teams should follow the instruction manual to complete the necessary mechanical mounting and electrical connections.

- Primary Category
 - 6 IR sensors
 - 1 Ultrasonic sensor (RCAP Finals)
 - 1 RGB sensor (RCAP Finals)
 - 2 DC motors
- Secondary Category
 - 6 IR sensors
 - 1 Ultrasonic sensor (RCAP Finals)
 - 1 Gyro sensor (RCAP Finals)
 - 1 RGB sensor (RCAP Finals)
 - 2 DC motors

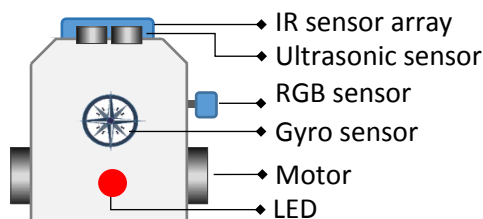


Figure 10: ROBOT_1 configuration

12.1.2 Teams may need to design and make additional accessories to accomplish the special tasks, if any. The width and length of the robot should remain unchanged.

12.1.3 Teams are not allowed to change motors, controllers, and sensors in this challenge.

12.1.4 There is no restriction on the weight, however it is important to note that the weight of the robot will affect the performance of the robot during the race.

12.1.5 It is encouraged to make to carry a small flag with a team name and team ID.



12.2 ROBOT_1 Control

12.2.1 Robot must be controlled autonomously. The use of a remote control, manual control, or passing information (by sensors, cables, wirelessly, etc.) to the robot is not allowed.

12.2.2 ROBOT_1 must be started manually by the team captain.

13 Virtual Robot (ROBOT_2)

13.1 ROBOT_2 Configuration

13.1.1 The ROBOT_2 configuration is the same for both primary and secondary categories. It has

- 6 IR sensors
- 1 Ultrasonic sensor
- 1 Gyro sensor
- 1 RGB sensor
- 2 DC motors
- 1 LED

14 Robot Coding

14.1.1 Teams are encouraged to use the CoSpace F1 simulator to develop appropriate strategies for ROBOT_1 and ROBOT_2.

14.1.2 Teams can develop two different programs, one for ROBOT_1 and one for ROBOT_2 to improve its performance in the respect world.

14.1.3 Teams need to do the sensor calibration for the ROBOT_1 based on lighting conditions for better performance.

CHAPTER 4: JUDGING AND AWARD

15 CoSpace Grand Prix Procedure

15.1 Release of Task

15.1.1 The tasks for both real and virtual challenges will be released to teams prior to the race.

15.2 Submission of AI

15.2.1 The chief judge will announce the time for AI submission in the competition hall.

15.2.2 Each team must submit their first AI strategy which is created during the programming period (we'll call it AI_1) to the chief judge.

15.3 Start of Each Round of Race

15.3.1 5 minutes before each round of race

- Team captains must report to the referee at the respective race stations.
- Teams are allowed to submit the revised version of AI to the referee if teams wish make a change to earlier AI. No modification of AI is allowed when the round of race begins. The referee will continue to use AI_1 if there is no revised AI submission of.

16 Technical Challenge (Only applicable for the RCAP Finals)

The Technical Challenge is to evaluate individual team's capability in AI planning and coding. The Technical Challenge tasks will be announced on site. It is not compulsory for all teams to participate in the technical challenges.

16.1 Passing Challenge (Real)

16.1.1 The passing challenge takes place in WORLD_1. ROBOT_1 is required to race from "START" to "END" station. ROBOT_1 is required to avoid all obstacles and to stop at each Pit Stop (RGB sensor detects the Pit Stop) with LED flashing for 3 seconds. ROBOT_1 will then exit the Pit Stop autonomously.

16.1.2 The time allowed is 3 minutes.

16.1.3 The team that passes all pit stops and obstacles in the shortest possible time will be declared the winner.

16.1.4 Sample WORLD_1 for passing challenge (real):

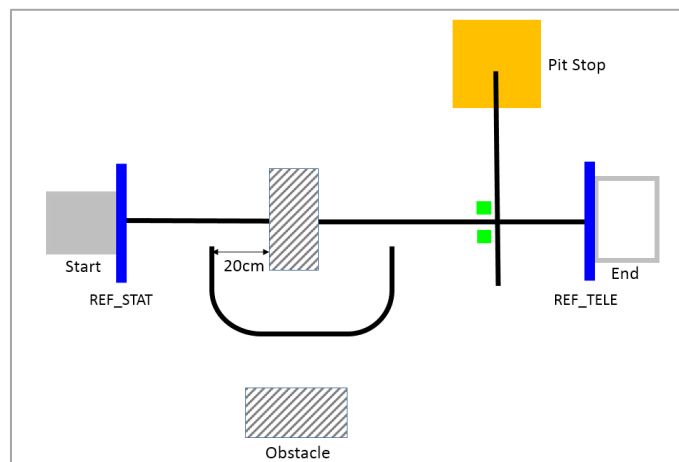


Figure 11: Passing Challenge (Real)

16.2 Passing Challenge (Virtual)

16.2.1 The passing challenge (virtual) takes place in WORLD_2. ROBOT_2 is required to pass all pit stops in the correct sequence while racing from start line to the finish line.

16.2.2 The time allowed is 8 minutes.

16.2.3 The team that passes all pit stops in the shortest possible time will be declared the winner.

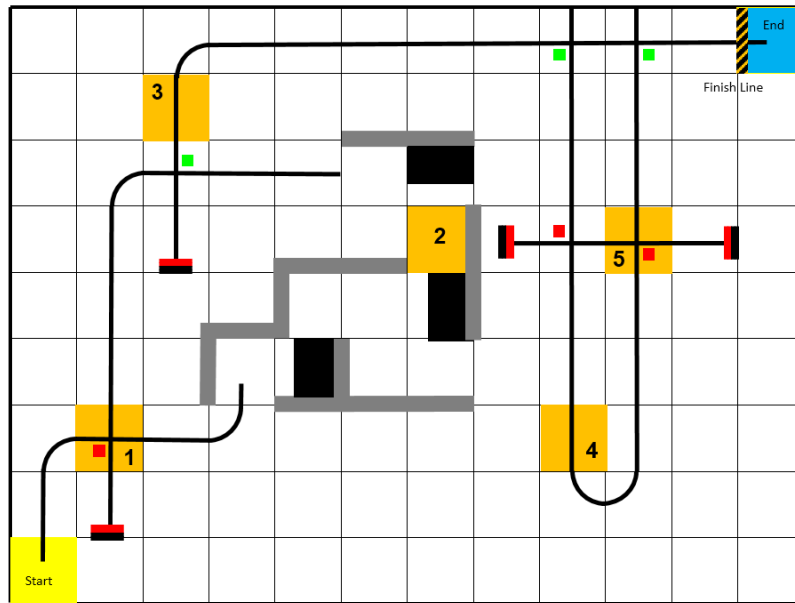


Figure 12: Passing Challenge (Virtual)

17 Grand Challenge

It is compulsory for every team to take part in the grand challenge.

17.1 Grand Challenge Description

17.1.1 In the CoSpace Grand Prix Challenge, teams will program both virtual and real robots to complete the run in racecourse. The race begins with the real robot racing on the real racetrack. The real robot will be teleported to the virtual world once it passes the REF_TELE. The virtual robot will continue the race in the virtual field. The team that reaches the finish line in the shortest possible time will be declared the winner.

17.1.2 The maximum duration for the CoSpace Grand Prix grand challenge is 8 minutes.

17.2 Real Race

17.2.1 The team captain will upload the programs to the ROBOT_1, place the ROBOT_1 in the initial station in WORLD_1 as instructed by the referee.

17.2.2 It is the team captain's responsibility to ensure that the correct program is uploaded.

17.2.3 Team captains must be present during the full length of the race.

17.2.4 Teams will be given 2 minutes for last-minute calibration and testing of the ROBOT_1 on the real field before the start of race.

17.2.5 The team captain will manually start the ROBOT_1. The race clock begins when it passes the "REF_STAT" gate.

17.2.6 Primary category:

- ROBOT_1 is required to race from "START" to "END" station. Teams are encouraged to make use of the Detour Markers to plan the best race route.



17.2.7 Secondary category:

- ROBOT_1 is required to race from “START” to “END” station. ROBOT_1 is required to stop at each Pit Stop (RGB sensor detects the Pit Stop), keep LED flashing for 3 seconds to indicate the refuelling process. ROBOT_1 will then exit the Pit Stop autonomously after refuelling.
- ROBOT_1 is required to avoid the obstacles if any.

17.2.8 Teams are encouraged to make use of the Detour Markers to plan the best race route.

17.2.9 When ROBOT_1 passes the REF_TELE gate, it shall stop and ROBOT_2 should be activated. The race clock continues. If the ROBOT_1 fails to move to the REF_TELE gate, the ROBOT_2 will not be activated.

17.3 Virtual Race

17.3.1 The referee will upload the programs to the CoSpace server, place the ROBOT_2 in the initial station in the WORLD_2.

17.3.2 It is the team captain’s responsibility to ensure that the correct program is uploaded.

17.3.3 Team captains must be present during the full race.

17.3.4 The ROBOT_2 will be activated only when the ROBOT_1 passes the REF_TELE gate.

17.3.5 ROBOT_2 is required to stop at each Pit Stop successfully.

- (a) In primary category, ROBOT_2 is required to pass all Pit Stops in any order.
- (b) In secondary category, ROBOT_2 is required to pass all Pit Stops in sequence, eg, Start -> Pit Stop 1 -> Pit Stop 2 -> Pit Stop 3 -> ... -> Finish Line.

17.3.6 If the ROBOT_2 fails to stop at Pit Stop successfully, the race continues. In this case, it is considered that the ROBOT_2 does not pass this Pit Stop.

17.3.7 The ROBOT_2 should avoid the obstacles.

17.3.8 Teams are encouraged to make use of the Detour Marker to plan the best race route.

17.3.8 When ROBOT_2 reaches the “Finish” line, the race ends.

17.4 Ranking

The teams are ranked as follows:

	Situation	Performance
Tier 1	<ul style="list-style-type: none"> • ROBOT_1 completes race in WORLD_1 • ROBOT_2 passes all Pit Stops • ROBOT_2 reaches the Finish Line 	<ul style="list-style-type: none"> • The robot performance is determined by the race time at the Finish Line.
Tier 2	<ul style="list-style-type: none"> • ROBOT_1 completes race in WORLD_1 • ROBOT_2 is not able to passes all Pit Stops (regardless whether it reaches the Finish Line or not) 	<ul style="list-style-type: none"> • The race time for ROBOT_2 to reach the last Pit Stop will be recorded. • The robot performance will be determined based on the number of Pit Stops passed followed by the race time.



Tier 3	<ul style="list-style-type: none">• ROBOT_1 is not able to complete race in WORLD_1	<ul style="list-style-type: none">• The robot performance will be determined based on the distance travelled followed by the race time.
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18 Awards

Depending on the number of teams entering the competition, there will be awards for trophies and certificates. The Organizing Committee can adjust the award type (trophy or certificate) if needed.

18.1 Trophy

RCAP CoSpace Grand Prix Grand Challenge winning teams

18.2 Certificate

RCAP CoSpace Grand Prix Technical Challenge – Best Passing (Real) Challenge Award

RCAP CoSpace Grand Prix Technical Challenge – Best Passing (Virtual) Challenge Award

Rule clarification: RCAP_Challenge@CoSpaceRobot.org

Technical support: support@CoSpaceRobot.org