RCAP CoSpace Grand Prix Rules 2018
(CoSpace F1, Category A)

These are the official rules for RoboCup Asia-Pacific (RCAP) CoSpace Grand Prix 2018, released by the RoboCup Asia-Pacific CoSpace Grand Prix Technical Committee. English rules have priority over any translations. Changes from the 2017 rules are highlighted in red.

PREFACE

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

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 on to a real robot in the real environment. Participating teams can contact support@cospacerobot.org for CoSpace F1 Simulator download, help and assistance.

Figure 1: CoSpace Grand Prix Challenge (Category A)

www.RoboCupAP.org

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CHAPTER 1: GENERAL RULES

1 Team

1.1. Team Members

1.1.1 A CoSpace Grand Prix team should consist of 2 to 4 members. Each participant can only register for one team.

1.1.2 All team members must be the right age for their respective age groups.

- U12 group: Teams with all students aged 9 to 12 year old can participate in this category.

- U19 group: 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.

1.1.3 Every team member needs to carry out a technical role for the team (strategy planning, programming, etc.), which should be identified at registration. Each member will need to explain his/her technical role and should be prepared to answer questions regarding the technical aspects of their involvement during preparation for 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 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 the 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 in the REAL_WORLD and the VIRTUAL_ROBOT in the VIRTUAL_WORLD to complete the Grand Prix mission.

2.3   Grand Challenge

2.3.1   The CoSpace Grand Prix grand challenge consists of a race in REAL_WORLD and VIRTUAL_WORLD. The maximum duration for the Grand Prix grand challenge is 8 minutes.

2.3.2   A challenge begins with REAL_ROBOT racing in REAL_WORLD while VIRTUAL_ROBOT is on standby in VIRTUAL_WORLD. When REAL_ROBOT passes the "REF_TELE" gate of the referee box (refer to section 3.2), VIRTUAL_ROBOT will be activated (Teleportation) to race in VIRTUAL_WORLD. REAL_ROBOT stops until the end of the race.
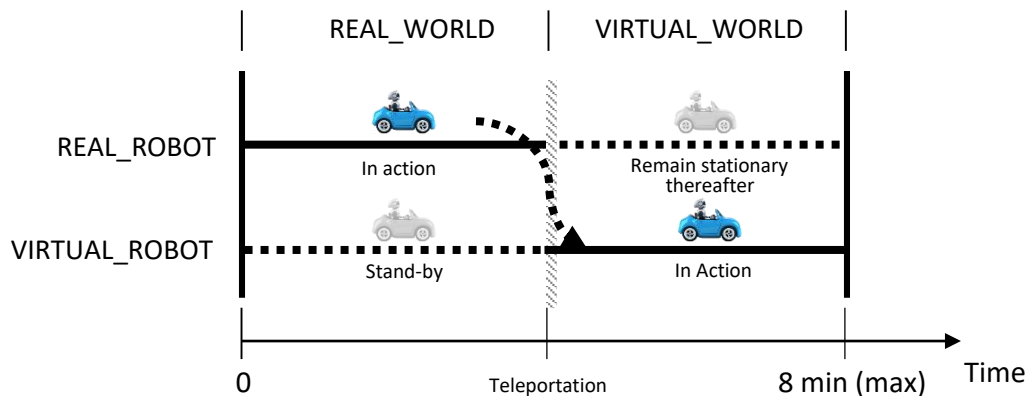

Figure 2: CoSpace Grand Prix process

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   The referee receives and uploads the 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 races in REAL_WORLD. It communicates with the CoSpace server throughout the whole competition. The referee box consists of the "REF_STAT" gate and "REF_TELE" gate.

3.2.2   Once the REAL_ROBOT passes "REF_STAT", the game clock begins. Once the REAL_ROBOT passes "REF_TELE", the team's VIRTUAL_ROBOT will be activated and the virtual race will be started. It is the organiser's responsibility to ensure the referee box is in good working condition.
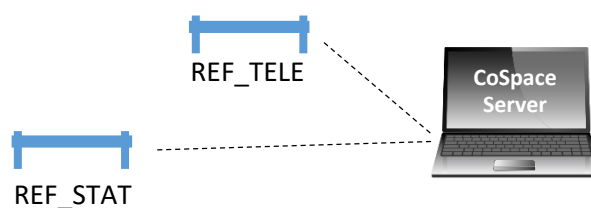

Figure 3: Referee Box

4 Human Interference

4.1.1 Except for resetting REAL_ROBOT 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 their team name in virtual race. Teams will be given a verbal warning if they fail to do so the first time. **The team will be disqualified for the current race if the team fails to add their team name for the second time**.

6 Interruption of a Race

6.1.1 In principle, a race will not be stopped during the challenge unless the 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. Captains are given a maximum of 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 on the result sheet and sign it.

7.1.3 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.

7.2. Rule Clarification

7.2.1 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 Grand Prix Technical Committee.

7.2.2 If necessary, a rule clarification may be made by members of the CoSpace Grand Prix Technical Committee and Organizing Committee, even during a tournament.

7.3. Special Circumstances

7.3.1 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.

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 in 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 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 of the end of the race in question. 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 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 which, it 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 track record;
- The innovative method used in programming the F1 racing robot ;
- What the team hopes to achieve in robotics.

9 Code of Conduct

9.1 Fair Play

9.1.1 CoSpace Grand Prix Challenge is built upon the foundation of fairness, respect and friendship. Team members should be mindful of other people and their robots when moving around the tournament venue.

9.1.2 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.

9.1.3 It is expected that the aim of all teams is to participate fairly.

9.2 Behaviour

9.2.1 Prior to the Challenge, team leaders and mentors are required to sign and acknowledge that they fully understand and are aware of the rules as well as Code of Conducts for the Challenge. All participants are responsible for their own actions.

9.2.2 During challenge, participants are to follow the directions of the referee. Failure to do so will result in a WARNING (Yellow Card). Subsequent infractions will result in an automatic DISQUALIFICATION (Red Card) of the round. Disqualification as a result of deliberately distract the competition is FINAL and appeals will not be entertained in any form. The status of Yellow/Red Cards will be recorded.

9.2.3 WARNING (Yellow Card) procedure

- A WARNING can be issued at the sole discretion of the lead referee; however, assistant referee will be consulted. If no objection is raised, WARNING will be issued.

- A WARNING will be issued for the following disruptive behaviours and activities including but not limited to:

    (a) Not following referee's instructions
    (b) Disturbing other participants and/or competition staffs (including referees).
    (c) Speaking loudly, shouting, using any kind of profanities or making sound that resembles profanity.
    (d) Sabotaging other teams belongings or equipment
    (e) Entering competition area when other teams are competing.
    (f) Entering other teams' area without explicit permission.
    (g) Engaging in disorderly conducts such as fighting, physical scuffles, running around competition and/or team area.
    (h) Harassing referee
    (i) Mentor interference with robots or referee decisions.

9.2.4 DISQUALIFICATION (Red Card) procedure

- A DISQUALIFICATION can be issued at the sole discretion of the lead referee; however, assistant referee will be consulted. If no objection is raised, DISQUALIFICATION will be issued.

- An immediate DISQUALIFICATION can only be issued jointly by the lead and assistant referee. A DISQUALIFICATION will be issued for the following cases:

    (a) Teams have collected two consecutive WARNINGS during competition period. A competition period is defined as the start to end of duration of competition.
    (b) Teams that cause a deliberate interference with real robots or damage to the real-world setup.
    (c) If one team copies a program from another team, both teams will be disqualified.

9.2.5 Once the RED CARD is issued, the team will be disqualified from the current race. If team receives 2 RED CARDS, it will be disqualified from the whole entire competition.

9.2.6 All immediate DISQUALIFICATION will be reviewed by the Chief Judge and the Organising Committee. Infractions that resulted in immediate DISQUALIFICATION will be reviewed and additional sanctions such as bans from future competitions will be considered.

9.3 Sharing

9.3.1 Teams are encouraged to share their programming and strategies with 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_WORLD

10.1 REAL_WORLD Dimension

10.1.1 The dimensions of the REAL_WORLD are 180cm x 240cm.

10.1.2 The floor may be either smooth or textured and may have steps and/or gaps of up to 3 mm. It can also be printed on a canvas.

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

10.2 REAL_WORLD Layout

10.2.1 The REAL_WORLD may consist of any of the following:

- U12 Group:
    - Black Guidelines
    - Obstacles
    - Mysterious Tasks

- U19 Group:
    - Black Guidelines
    - Obstacles
    - Ramps/Bridges
    - Mysterious Tasks

10.2.2 Black Guidelines

- The black guideline (1.8 -2 cm wide) may be made with standard electrical insulating tape, or printed onto other materials.

- The black guideline forms a path to guide REAL_ROBOT during the race in REAL_WORLD.

- 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 4: 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 to the size.

10.2.5 Mysterious Tasks

In REAL_WORLD, there may be mystery tasks that will only be released on the competition day.

10.2.6 Re-Start Markers

The re-start marker indicates the re-start position of the real robot when it is Lack of Progress (refer to 16.2.8). The re-start marker is orange in colour. It can be 5 mm to 10mm thick and up to 70 mm in diameter. The number of possible re-start markers will depend on the length of the course.
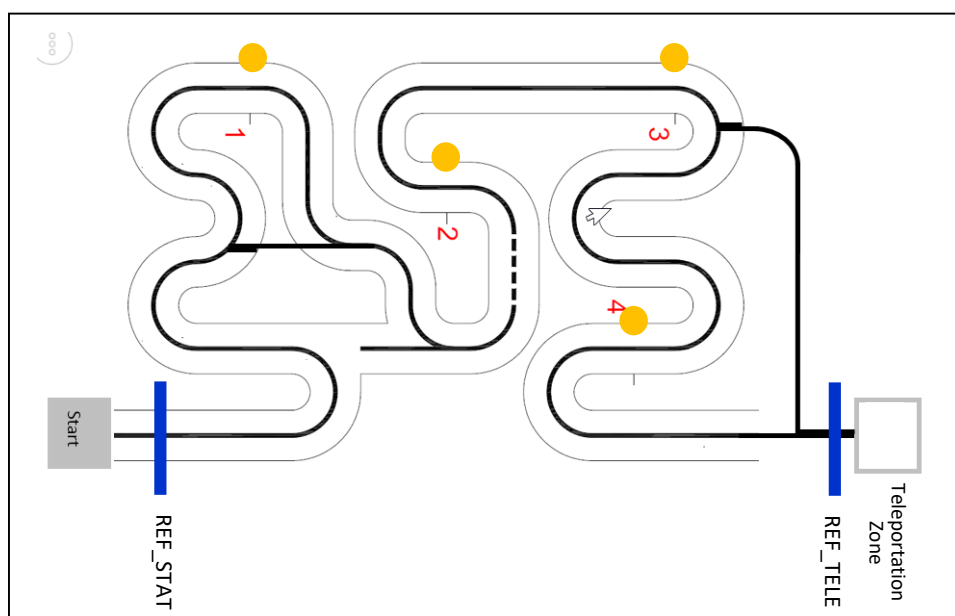
Typical REAL_WORLD layout:

Figure 5: Real Field Layout

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. camera flashes from spectators).. Though organizers and referees will do their best to minimize external lighting interferences, teams should also prepare their robots to handle such interferences.

11 VIRTUAL_WORLD

11.1 VIRTUAL_WORLD Dimension

11.1.1 The dimensions of VIRTUAL_WORLD will be less than 300cm x 400cm.

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

11.2 VIRTUAL_WORLD Layout

11.2.1 The VIRTUAL_WORLD may consists any of the following:

- U12 Group:
    o Black Guidelines
    o Obstacles
    o Pit Stops
    o Detour Markers
    o Mysterious Tasks

- U19 Group:
    o Black Guidelines
    o Obstacles
    o Pit Stops
    o Detour Markers
    o Ramps/Bridges
    o Mysterious Tasks

11.2.2 Black Guideline, Obstacles, Pit Stops, Detour Markers

The specifications of the black guidelines and Ramps/Bridges are the same as in the real field. Please refer to section 10.2.2 - 10.2.6 for details.

11.2.3 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, or as a penalty, or any combination of the above.

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

Figure 6: Pit Stop

11.2.4 Detour Markers

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

Figure 7: Sample of detour markers

11.2.5 End Markers

The end marker is as shown in figure 8. This is the terminal point of the black guideline.

Figure 8: End Marker

11.2.6 Finish Lines

The mission is completed when VIRTUAL_ROBOT passes the finish line.
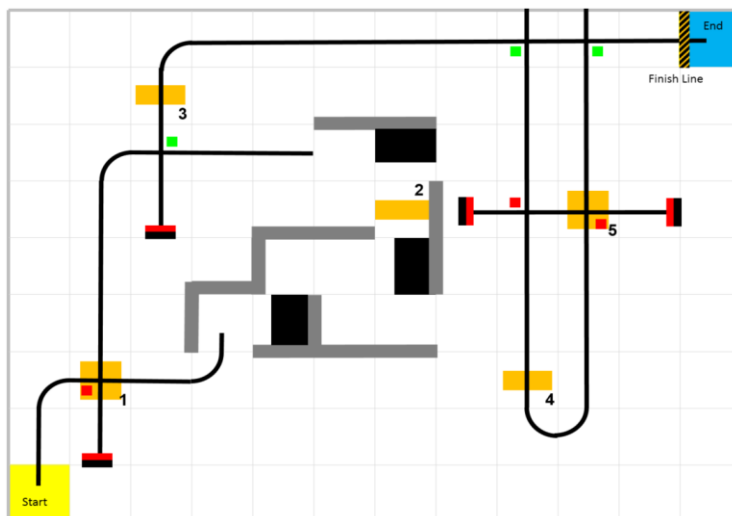
Typical VIRTUAL_WORLD layout:

Figure 9: VIRTUAL_WORLD Layout

CHAPTER 3: ROBOT

12 REAL_ROBOT

Teams are required to have their own Standard Robot Platform for the challenge.

12.1 REAL_ROBOT Construction

12.1.1 The basic design of the REAL_ROBOT 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. The REAL_ROBOT has the following configuration:

- o 6 IR sensors
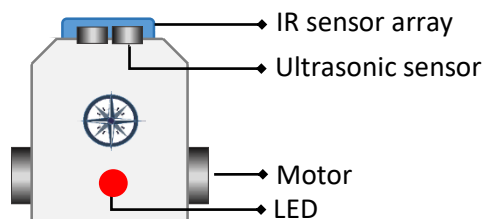- o 1 Ultrasonic sensor
- o 2 DC motors
- o LED

Figure 10: REAL_ROBOT 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 the motors, controllers and sensors in this challenge.

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

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

12.2 REAL_ROBOT Control

12.2.1 The 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 REAL_ROBOT must be started manually by the team captain.

13 VIRTUAL_ROBOT

13.1 VIRTUAL_ROBOT Configuration

13.1.1 The VIRTUAL_ROBOT configuration is as follows:

- 6 IR sensors (both U12 & U19)
- 1 Ultrasonic sensor (both U12 & U19)
- 1 Gyro sensor (Compass + Tilt, U19 only)
- 1 RGB sensor (both U12 & U19)
- 2 DC motors (both U12 & U19)
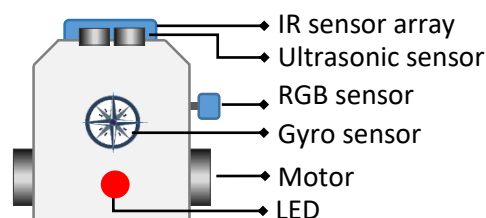- 1 LED (both U12 & U19)

Figure 11: VIRTUAL_ROBOT configuration

14 Robot Coding

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

14.1.2 Teams can develop two different programs, one for REAL_ROBOT and one for VIRTUAL_ROBOT, to improve their performances in the respective worlds.

14.1.3 Teams need to calibrate the sensors of the REAL_ROBOT based on lighting conditions of the field for better performance.

CHAPTER 4: GAMEPLAY, 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 the race

- Team captains must get real robot ready and report to the referee at their respective race stations.

- Teams are allowed to submit a revised version of their AI to the referee if they wish make a change to their earlier AI. No modification of AI is allowed once the round of race begins. The referee will continue to use AI_1 if there is no submission of revised AI.

16 Grand Prix Challenge

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

16.1 Grand Prix Challenge Description

16.1.1 In the CoSpace Grand Prix Challenge, teams will program both virtual and real robots to complete a run in the 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 REF_TELE. The virtual robot will then continue the race in the virtual racetrack. The team that reaches the finish line in the shortest possible time will be declared the winner.

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

16.2 Real Race

16.2.1 The team captain will upload the programs to the REAL_ROBOT, place the REAL_ROBOT in the initial station in REAL_WORLD as instructed by the referee.

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

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

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

16.2.5 The team captain will manually start the REAL_ROBOT. The clock begins when the robot passes the "REF_STAT" gate.

16.2.6 REAL_ROBOT is required to complete any mystery tasks between the "START" and "END" stations. Teams are encouraged to make use of colour makers to plan the best racing path unless the racing path is specified by the referee.

16.2.7 A lack of progress occurs when:

    (a) the team captain declares a Lack of Progress
    (b) the robot loses the black line without regaining it back
    (c) a robot does not follow the indicated direction
    (d) a robot fails to complete the mysterious task.

16.2.8 If a Lack of Progress occurs, the robot must be positioned on the previous re-start marker facing the path towards the teleportation zone and checked by the referee.

16.2.9 After a Lack of Progress, the team may reset the power supply (turn the robot off and on) and subsequently restart the program. The team is not allowed to change the program, give any information about the field to the robot, or repair the robot.

16.2.10 There will be maximum of 3 re-starts allowed within a race. The number of the re-starts will not be considered as further penalty in any form.

16.2.11 When REAL_ROBOT passes the REF_TELE gate, it should stop and VIRTUAL_ROBOT should be activated. The race clock continues. If the REAL_ROBOT fails to move to the REF_TELE gate, the VIRTUAL_ROBOT will not be activated.

16.3 Virtual Race

16.3.1 The referee will upload the programs onto the CoSpace server and place the VIRTUAL_ROBOT in the initial station in the VIRTUAL_WORLD.

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

16.3.3 Team captains must be present during the full race.

16.3.4 The VIRTUAL_ROBOT will be activated only when the REAL_ROBOT passes the REF_TELE gate.

16.3.5 U12 Group,

    (a) VIRTUAL_ROBOT is required to pass all Pit Stops successfully in any order.

    (b) VIRTUAL_ROBOT does not need to stop at the Pit Stop.

16.3.6 U19 Group,

    (a) VIRTUAL_ROBOT is required to pass all Pit Stops successfully in sequence, eg, Start -> Pit Stop 1 -> Pit Stop 2 -> Pit Stop 3 -> … -> Finish Line.

    (b) VIRTUAL_ROBOT is required to stop at each Pit Stop with LED flashing for 2 seconds.

    (c) If the VIRTUAL_ROBOT fails to stop at a Pit Stop successfully, the race continues. In this case, it is considered that the VIRTUAL_ROBOT does not pass this Pit Stop.

16.3.7 The VIRTUAL_ROBOT should avoid all obstacles.

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

16.3.9 When VIRTUAL_ROBOT reaches the "Finish" line, the race ends.

16.4 Ranking

The teams are ranked as follows:

	Situation	Rank
Tier 1	• REAL_ROBOT completes race in REAL_WORLD • VIRTUAL_ROBOT passes all Pit Stops • VIRTUAL_ROBOT reaches the Finish Line	• The team rank is determined by the race time at the Finish Line in the VIRTUAL_WORLD.
Tier 2	• REAL_ROBOT completes race in REAL_WORLD • VIRTUAL_ROBOT is not able to passes all Pit Stops (regardless whether it reaches the Finish Line or not)	• The race time for VIRTUAL_ROBOT to reach the last Pit Stop will be recorded. • The team rank will be determined based on the number of Pit Stops passed followed by the race time.

Tier 3	• REAL_ROBOT is not able to complete race in REAL_WORLD even after 3 re-starts.	• The team rank will be determined based on real zone it has passed. The team reached further real zone will be considered to have better ranking. • In any case, teams will be given a chance to race in VIRTUAL_WORLD. • If two teams have passed the same zone in the REAL_WORLD, then the team having better performance in VIRTUAL_WORLD is considered to have better ranking.

17   Awards

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

Rule clarification: RCAP_Challenge@CoSpaceRobot.org

Technical support: support@CoSpaceRobot.org