

RoboCupJunior Rescue Simulation – Rules 2020 (former CoSpace)

RoboCupJunior Rescue Technical Committee 2020

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RoboCupJunior Rescue Technical Committee 2019

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These are the official rules for RoboCupJunior Rescue Simulation (former CoSpace) **2020**. They are released by the RoboCupJunior Rescue Technical Committee. The English rules have priority over any translations. **Changes from the 2019 rules are highlighted in red.**

Preface

In Rescue Simulation (former CoSpace), teams have to develop and program appropriate strategies for both real and virtual autonomous robots to navigate through the real and virtual worlds to collect objects while competing with another team's robot that is searching and collecting objects in the same real and virtual worlds. For the individual **team** competition, **only** the **virtual worlds and virtual robots** are used. **Real robot and real arena will be used in SuperTeam competition.**





Official RoboCupJunior site: <http://junior.robocup.org/rescue/>

Official RoboCupJunior forum: <https://junior.forum.robocup.org/>

Rescue CoSpace Simulator: <https://www.CoSpaceRobot.org/>

In the 2020 Rescue Simulation Rule book, two sets of rules will be delivered:-

- **Rules for Preliminary Level:** This rule is for teams where all members are under the age of **13** and are thus **NOT ELIGIBLE** to compete in the RoboCup International competition. **Rules for Preliminary Level is being released for regional or super-regional competitions only (if applicable).**
- **Rules for Advanced Level:** This rule is for teams where one of more members is **13** years old as described by the RoboCupJunior Rules and are thus eligible to compete at the RoboCupJunior International competition. **Rules for Advanced Level is being released for qualification for the international event, super-regional event and International event.**

The Rescue CoSpace Simulator is the only official platform for the sub-league. **Rescue CoSpace Simulator is designed for Rescue Simulation according to the rules released by RoboCupJunior Rescue Technical Committee.**

The Rescue CoSpace Simulator covers the following:

- **Preliminary Level Challenge**
- **Advanced Level Challenge**
- **SuperTeam Challenge**

The **Rescue CoSpace Simulator** can be downloaded at <http://www.cospacerobot.org>. This simulator allows programs to be developed using a graphical programming interface or C language.

The Rescue CoSpace Simulator user keys must be obtained from <http://cospacerobot.org/download/registration>. If you have any problems with registration keys please contact key_request@cospacerobot.org.

Please refer to Rescue CoSpace Simulator help or CoSpaceRobot.org for details. You can also contact support@cospacerobot.org for technical assistance, all other questions please refer to the junior forum. The CoSpace user guide is packed in the Rescue CoSpace Simulator.

Overview

Individual Team Challenge:

In the RoboCup World Championship, teams are judged in three areas: Technical Interview, Technical Challenge, and Tournament.

- **Technical Interview:** 10 to 15 minutes face-to-face interview between the team and the judges in which all team members are required to present the Team Description Paper. Judges are interested in determining students' understanding of the robotics AI and coding skills. Each team member must be prepared to answer questions about the technical aspects of their involvement in preparing the Rescue Simulation (former CoSpace) Challenge.

Teams may be asked to have a second interview after the Technical Challenge, Round Robin or Finals, if judges consider it is necessary. Teams must show authenticity and originality with regards to the AI and code. Teams can take the Rescue Simulation (former CoSpace) Interview Score Sheet as reference while preparing for the technical interview.

- **Technical Challenge:** The Technical Challenge is compulsory for all teams. It is to evaluate individual team's capability in AI planning and coding. The Technical Challenge task will be announced onsite. The format may be completely different from the traditional Rescue Simulation (former CoSpace) mission. Teams are required to submit the solution within 2 hours. The Technical Challenge result will be counted as the evaluation criteria for the "winner of the round robin" and the "Best Strategy Award".
- **Tournament:** The tournament begins with Round Robin games. The winner of the round robin is determined based on Technical Challenge results (30%) and total GAME POINTS from Round Robin games (70%). The top 8 teams will advance to the Quarter-Finals, Semi-Finals and Final. The winner of the Finals will be decided solely based on the quarter- /semi- /final game result. Teams that could not enter the finals will join the Friendship Tournament.

Best Strategy Challenge:

In order to encourage students into a Robotics and AI related field, the Best Strategy Challenge is setup for individual team members who have passion and talent in Robotics AI and coding. The Best Strategy Challenge is not compulsory for every team member. The task will be announced onsite. Students will have two and a half-hours to complete the task.

SuperTeam Challenge:

At the international RoboCupJunior Rescue Simulation (former CoSpace) Challenge, teams will also take part in a SuperTeam Competition. SuperTeams comprise of two or more participating teams. The SuperTeams are given a short period of time for collaboration at the competition venue. During this time, each SuperTeam must leverage on individual teams' strengths and work together to create a new AI to solve a new task. SuperTeams are encouraged to express their friendship and cooperation and demonstrating what they have learned from each other. The SuperTeam Challenge is a special program for the international event and is not obligatory for regional events.

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Part 1: General Rules

1 Team

- 1.1.1 A team should have 2 or more members to form a RoboCupJunior team to participate in the International event. Maximum team size is 4 members for RoboCupJunior 2020. Each participant can only be registered on one team in RoboCupJunior.
- 1.1.2 All team members must be the correct age as stated on the RCJ website <http://junior.robocup.org/robocupjunior-general-rules/> under "Ages".
- 1.1.3 Every team member needs to carry out a technical role for the team (strategy planning, programming, etc.), this should be identified at registration. Each member will need to explain his/her technical role and should be prepared to answer questions about the technical aspects of their involvement in preparing the Rescue Simulation (former CoSpace) Challenge.
- 1.1.4 Teams should be responsible for checking **all** updated information (schedules, meetings, announcements, etc.) during the event.
- 1.1.5 Teams are grouped into two levels: Preliminary Level and Advanced Level:
- Preliminary Level – for teams with all members under 13 who are **NOT ELIGIBLE** to compete at the RoboCup World Championship.
 - Advanced Level – for teams where one member is 13 or older as described by the RoboCupJunior Rules. The Advanced Level is **ELIGIBLE** for RoboCup World Championship.
- 1.1.6 Each team must have a captain. The captain is the person responsible for communication with referees during the game.

2 Conflict Resolution

2.1 Referee

- 2.1.1 During gameplay, the referee's decisions are final.
- 2.1.2 At the conclusion of game play, the referee will ask the captain to sign the score sheet. The captain should be given maximum 1 minute to review the score sheet and sign it. By signing it, the captain accepts the final score on behalf of the entire team. In case of further clarification, the team captain should write their comments on the score sheet and sign it.

2.2 Rule Clarification

- 2.2.1 It is the team's responsibility to verify at the RoboCupJunior Official website about the latest version of the rules prior to the competition. If any rule clarification is needed, please contact the International RoboCupJunior Rescue Technical Committee.
- 2.2.2 If necessary even during a tournament, a rule clarification may be made by members of the RoboCupJunior Rescue Technical Committee and Organizing Committee.

2.3 Special Circumstances

- 2.3.1 If special circumstances, such as unforeseen problems of **hardware/software platform** occur, rules may be modified by the RoboCupJunior Rescue Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, if necessary even during a tournament.
- 2.3.2 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 2.3.1, it will be considered as an agreement.

3 Documentation

3.1 Learning Journal **(Preliminary Level Only)**

- 3.1.1 The learning journal is a collection of notes, observations, thoughts and reflection throughout the whole preparation of RCJ Rescue simulation Challenge. It is expected for the regional or super-regional events.
- 3.1.2 Each team is required to submit the learning journal before the interview session. Teams are required to explain the key points addressed in the learning journal during the interview. Teams may be called upon to help establish the authenticity of a team's performance.
- 3.1.3 The format of learning journal can be found in section 24.

3.2 Team Description Paper **(Advanced Level Only)**

- 3.2.1 The Team Description Paper (TDP) submission is expected for the world championships and maybe useful for **regional or super-regional events**.
- 3.2.2 Each team is required to submit a TDP to the Rescue Simulation (former CoSpace) Technical Committee for review about two weeks before the official starting date of the RoboCupJunior competition. Teams are required to explain the TDP during the interview. Teams may be called upon to help establish the authenticity of a team's performance.
- 3.2.3 **The format of TDP can be found in section 25.** Teams can also download it from <http://junior.robocup.org/rescue-simulation-league-former-cospace-league/>.

3.3 Poster

- 3.3.1 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.
- 3.3.2 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 school and country and location within country
 - Team's track record
 - Description of algorithm used for developing the searching and placement strategies
 - Any interesting or unusual features of their programs

- What the team hopes to achieve in robotics.

4 Code of Conduct

4.1 Fair Play

- 4.1.1 Humans that cause deliberate interference with real robots or damage to the real arena setup will be disqualified.
- 4.1.2 It is expected that the aim of all teams is to participate fairly.

4.2 Behavior

- 4.2.1 If one team copies a program from another team, both teams will be disqualified.
- 4.2.2 Teams will be disqualified for deliberately trying to lose the game or tie with the opponent team.
- 4.2.3 Team members should be mindful of other people and their robots when moving around the tournament venue.
- 4.2.4 Team members are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by team members.
- 4.2.5 Team members who misbehave may be asked to leave the building and risk being disqualified from the tournament.
- 4.2.6 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.
- 4.2.7 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 programming of students' robots. Mentor interference with robots, **coding**, or referee decisions will result in a warning in the first instance. If this reoccurs, the team will risk being disqualified.

4.3 Sharing

- 4.3.1 Teams are encouraged to share their programming and strategies to the members from other teams.
- 4.3.2 Any developments may be published on the RoboCupJunior website after the event.
- 4.3.3 This furthers the mission of RoboCupJunior as an educational initiative.

4.4 Spirit

- 4.4.1 It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.
- 4.4.2 The referees and officials will act within the spirit of the event.
- 4.4.3 It is not whether you win or lose, but how much you learn that counts!

Part 2: Individual Team Challenge (Preliminary Level)

5 Game Description

5.1 Game process

- 5.1.1 A game lasts 8 minutes, with two teams competing in one game. A game consists of WORLD_1 and WORLD_2. A team has one robot in each WORLD as shown in figure 1.
- a) ROBOT_1 can spend between 3-5 minutes in WORLD_1.
 - b) ROBOT_2 will spend the remaining time in WORLD_2.
- 5.1.2 A team must program ROBOT_1 and ROBOT_2 to navigate and collect objects in WORLD_1 and WORLD_2. A team must end ROBOT_1 and activate the ROBOT_2 when transferring from WORLD_1 to WORLD_2 (refer section 5.3).
- 5.1.3 Only one robot can move at any one time. When ROBOT_1 moves in WORLD_1, ROBOT_2 must be in standby mode. When the ROBOT_2 is activated, ROBOT_1 stops until the end of the game.

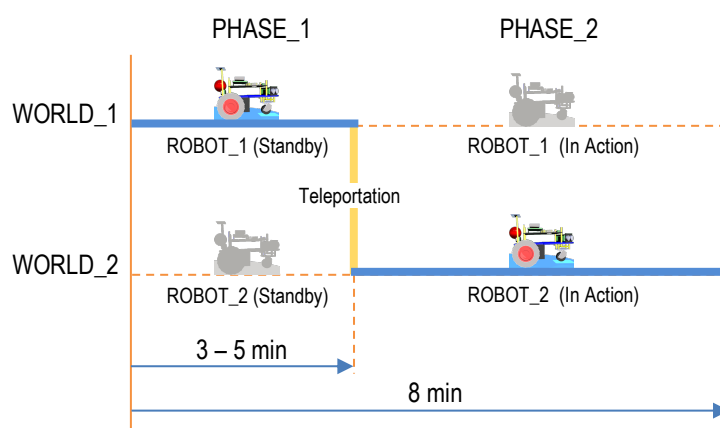


Figure 1: Rescue Simulation (former CoSpace) Game Process

5.2 Phase_1

- 5.2.1 A game begins with ROBOT_1 navigating in WORLD_1.
- 5.2.2 In the WORLD_1, ROBOT_1 searches for 3 types of objects, RED, CYAN, and BLACK objects. ROBOT_1 has to collect the objects and then deposit them in the collection box to receive points. It cannot collect more than 6 objects at any one time without depositing them in the collection box.
- 5.2.3 Bonus points will be awarded for every set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the collection box (refer to section 8.3.4).

5.3 Teleportation

Teleportation means ending ROBOT_1's movement in WORLD_1 and activating the team's ROBOT_2 in WORLD_2.

- 5.3.1 A team needs to teleport their ROBOT_1 at any time after 3 minutes but before the first 5 minutes passed whilst ending the ROBOT_1's movement.
- 5.3.2 Teleportation within the first 3 minutes is invalid.
- 5.3.3 If a team fails to teleport by the end of the first 5 minutes, ROBOT_2 will be activated by the CoSpace server automatically (refer to section 8.3.5).

5.4 Phase_2

- 5.4.1 In WORLD_2, ROBOT_2 searches for 5 types of objects, RED, CYAN, BLACK, SUPER and SUPER+ objects. ROBOT_2 has to collect the objects and deposit them in the collection box to receive points. It cannot collect more than 6 objects at any one time without depositing them in the collection box.
- 5.4.2 SUPER or SUPER+ objects will be created upon every set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the collection box (refer to section 7.4.1).

5.5 Competition Setup

- 5.5.1 Individual Team Challenge: WORLD_1 and WORLD_2 are virtual. ROBOT_1 and ROBOT_2 are virtual (refer to section 21.1).

6 Robot

- 6.1.1 In the Preliminary level, teams are only required to program the virtual robot for both WORLD_1 and WORLD_2. The configuration of virtual robot is shown as in section 20.
- 6.1.2 During the competition, the coordinates of both BLUE and RED robot will not be provided.
- 6.1.3 Virtual robots must be controlled autonomously.

7 Arena

7.1 Layout

- 7.1.1 The dimensions

- WORLD_1: 180cm x 240cm
- WORLD_2: 270cm x 360cm

- 7.1.2 Boundary:

WORLD_1 and WORLD_2 will be enclosed by a wall of height 15 cm.

7.1.3 WORLD_1 and WORLD_2 are 3D simulated virtual environment. Both WORLDS contain objects, static obstacles, traps, markers, collection boxes and special zones. The floor is generally white or light colored.

7.1.4 Section 21.1 shows the sample layout of WORLD_1 and WORLD_2.

7.2 Markers, Obstacles, Special Zones, Traps, and Collection Boxes

7.2.1 **Markers.** There may be some markers in the WORLD_1 and WORLD_2. The makers can be used to help the ROBOT_1 and ROBOT_2 for its localization, guidance, etc. The minimum size of the marker is 2cm x 2cm. The colour and shape of the marker is not fixed.

7.2.2 **Obstacles.** The static obstacles are placed in WORLD_1 and WORLD_2. It can be of any size, any shape with the minimum dimensions of 10cm x 10cm. The obstacle will not move throughout the whole competition.

7.2.3 **Special Zones.** Certain areas in WORLD_1 and WORLD_2 are designated as special zones. RED, CYAN and BLACK objects collected in these areas are worth double points. The special zone is blue in colour as shown in figure 2. The special zones have a minimum size of 30cm x 30cm. The shape of the special zone is not fixed.

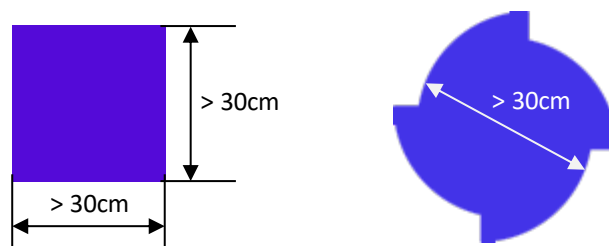


Figure 2: Sample of Special

7.2.4 **Traps** are surrounded by a yellow boundary (warning area) as shown in figure 3. The minimum size of the trap is 10cm x 10cm. The traps can be any colour. The shape of traps is not fixed. If a robot goes over a trap it will lose any objects it is currently carrying.

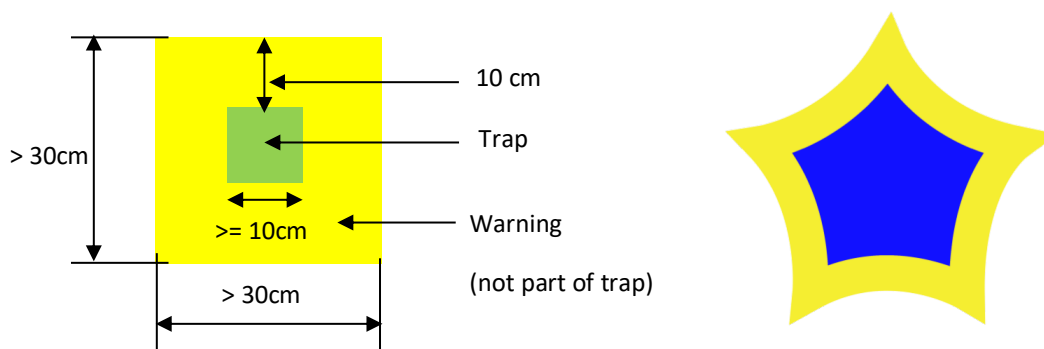


Figure 3: Sample of Traps

7.2.5 Figure 4 shows the **object collection box**. The collection box is ORANGE in colour. The dimensions of the deposit box are approximately 30 x 30 cm. The collection box can be any shape.

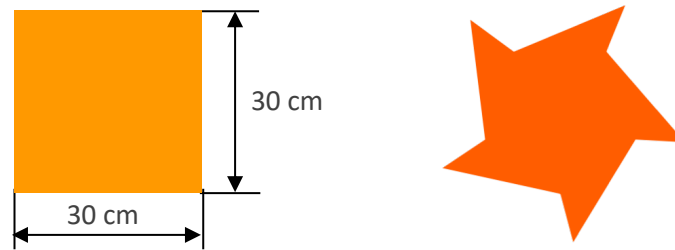


Figure 4: Sample of object collection boxes

7.3 Objects

7.3.1 There are THREE types of objects, RED, CYAN, and BLACK located randomly throughout the course. Each type of objects are worth different values (refer to section 8.3.2). The colour, shape, and size of objects are fixed. They are square or round in shape in general.

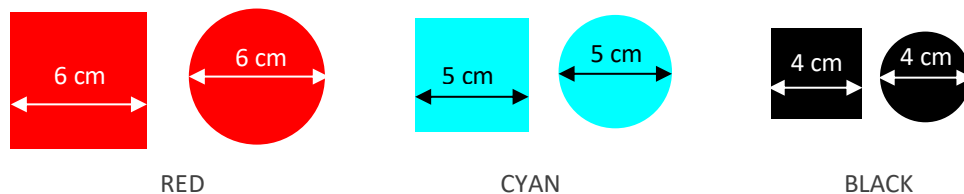


Figure 5: Objects (Preliminary Level)

7.4 SUPER and SUPER+ Objects (WORLD_2 Only)

7.4.1 Creation of SUPER and SUPER+ objects

- ONE SUPER Object will be generated for every ONE set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to Collection Box in the WORLD_2. (refer to section 8.3.3)
- ONE SUPER+ Object will be generated for every TWO sets of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the Collection Box in the WORLD_2.
- The SUPER or SUPER+ objects generated by BLUE team can only be collected by the BLUE team itself. The SUPER or SUPER+ objects generated by RED team can only be collected by the RED team itself.

7.4.2 Size, colour and shape of SUPER and SUPER+ objects

The SUPER and SUPER+ objects are about 5cm in diameter. They are circular in shape and purple in colour.

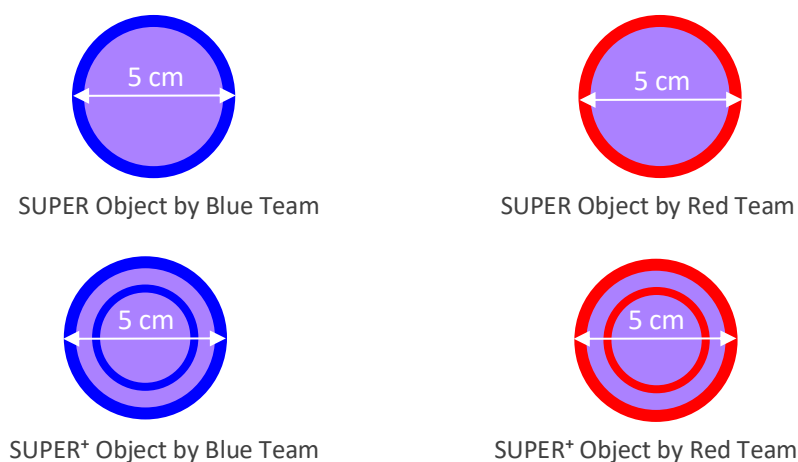


Figure 6: SUPER and SUPER+ objects

7.4.3 Placement of SUPER and SUPER+ objects

The SUPER and SUPER+ objects will be placed on the lines 15 cm away from the wall (refer to section 21.1). The line reference number (Line 1, 2, 3, or 4) will be sent to the respective team upon the SUPER and SUPER+ objects' creation.

8 Gameplay

8.1 Map Release

8.1.1 The layout (the maps) of WORLD_1 and WORLD_2 will be released to teams prior to the competition (typically approximately two hours beforehand). This allows teams to **design**/tailor their program and strategy for the specific field.

8.2 Game Procedure

8.2.1 A referee is an official who receives and uploads teams' programs as well as runs the games.

8.2.2 At the end of each programming period:

- a) The chief judge will announce the time for program submission in the competition hall.
- b) 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.

8.2.3 Five minutes before each game:

- a) Team captains must report to the referee at the respective game stations.
- b) The OC determines whether it is possible to change the AI submitted by the team. If the OC determines that a delay in the schedule occurs, the team can not change the AI.

8.2.4 Three minutes after the scheduled game time:

If a team has not arrived at the game station 3 minutes after the scheduled game time, the team will forfeit the game. The opponent will gain 500 points and be declared as the winner. Kindly note that the scheduled game time might be delayed.

8.2.5 Pre-match Meeting:

Each team will be assigned a team colour (BLUE or RED). At the start of the game, the referee will toss a coin. The result determines the teams' colour.

8.2.6 Start of Play

- a) The referee will upload the programs to the CoSpace server, place the team's robot in the starting point in the virtual world and start the virtual game.
- b) It is the team captain's responsibility to ensure the correct program is uploaded.
- c) Team captains must be present during the full length of the game.

8.3 Scoring

8.3.1 A team will be given 100 points at the beginning of each game.

8.3.2 Collecting objects

- a. A team will gain points by collecting the objects.

To indicate that a robot has collected an object, it must stop and flash the LED for 3 seconds when any one of the colour sensor has detected the object.

Object Type	Points in WORLD_1 (Virtual)		Points in WORLD_2 (Virtual)	
	Regular Zone	Special Zone	Regular Zone	Special Zone
RED	10	20	10	20
CYAN	15	30	15	30
BLACK	20	40	20	40
SUPER	NA		90	90
SUPER*	NA		180	180

- b. A robot cannot collect more than 6 objects at any one time without placing them in the collection box. Objects in the virtual world will disappear after they are collected.

8.3.3 Depositing objects

When a robot deposits objects successfully, the points of the objects deposited will be doubled. “Robot deposits objects successful” means:

- a. A robot must stop inside the collection box with the LED steady ON for 3 seconds to indicate the depositing process;

A robot is only considered to be in the collection box when both colour sensors detect the collection box (both colour sensors are in the collection box).

- b. The robot will exit the collection box autonomously after deposition (both colour sensors are out of the collection box).

8.3.4 Bonus points (WORLD_1 Only)

- a. For every ONE set of RED, CYAN and BLACK objects collected and deposited successfully (in one single trip to the collection box) in WORLD_1, 90 bonus points will be rewarded. There will be no SUPER objects generated in WORLD_1.
- b. For every TWO sets of RED, CYAN and BLACK objects collected and deposited successfully (in one single trip to the collection box) in WORLD_1, 180 bonus points will be rewarded. There will be no SUPER+ objects generated in WORLD_1.

8.3.5 Communication and Teleportation

- a. For successful teleportation, teams will be given 100 bonus points. Teams can choose a location in WORLD_2 to which the robot will be teleported.
- b. For unsuccessful teleportation, the robot will be placed in WORLD_2 by the CoSpace server. No bonus will be given. Teams cannot choose the location in WORLD_2 to which the robot will be teleported.

8.3.6 Falling into a Trap

If a virtual/real robot falls into a trap, all objects that have been collected but not yet placed in the object collection box will disappear. Therefore, the points awarded for those objects collected will be deducted.

A virtual/real robot is considered to be in the trap if any one of the robot's colour sensor has detected the trap.

8.3.7 Game Points

After each match, following GAME POINTS will be given accordingly.

Game	GAME POINTS
Win	3
Tie	1
Loss	0

8.4 Human Interference

- 8.4.1 Except for a lack of progress, human interference (e.g. re-locate a virtual robot to any reset point) during the game is not allowed unless permitted by the referee. A violation of the rules may be penalized by disqualification from the tournament, the round or may result in loss of points as the discretion of the referee, officials, organizing committee or general chairs.
- 8.4.2 In any case, only the team captain is allowed to communicate with the referee.

8.5 Lack of Progress

- 8.5.1 When a virtual robot is stuck for 10 seconds, the robot will be relocated to a different location but close to where it was with different orientation by the CoSpace server.

In any case, including looping, the team captain can request to relocate the virtual robot to a different location. Upon team's request, the referee will call "**RELOCATE**" and the robot will be relocated to a different location but close to where it was with different orientation. However, the robot will be frozen for 10 seconds after relocation. The team can only call relocation up to 3 times in each game. The referee will keep track of the number of relocations requested.

- 8.5.2 A team may decide to stop a round early if the lack of progress cannot be resolved and 5 minutes have passed. In this case, the team captain must indicate to the referee the team's desire to terminate the game. The team will be awarded all points achieved.

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- 8.6.1 It is compulsory for teams to specify the team name in virtual games. 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 game if the team fails to add the team name for the second time in a virtual game.
- 8.6.2 If a robot is hit/attacked by another robot, the attacking robot will be separated from the attacked robot and repositioned at the same location with different orientation (if there is collision) and be frozen for 10 seconds. There will be no point deduction.
- 8.6.3 If two robots bump into each other, both robots will be separated from each other and repositioned at the same location with different orientation (if there is collision). Both robots will be frozen for 10 seconds. There will be no point deduction.

8.7 Re-match

In unforeseen circumstances, the game cannot be continued during the match, the RCJ Rescue Simulation Organising Committee will work with the Technical committee to evaluate the cause of the incident.

- a. If it is solely caused by a team, the opposing team will be declared as the winner of this game and 500 points will be awarded.
- b. If no conclusion can be drawn on the cause of the incident, the Referee will call a re-match.

8.8 Interruption of Game

- 8.8.1 In principle, a game will not be stopped during gameplay.
- 8.8.2 The referee can end a game when all objects have been collected by the robots.
- 8.8.3 The referee can pause a game when the game coordinator/referee needs to discuss an issue/problem with the OC/TC. The game will be called “time-out” in this case.
- 8.8.4 Teams are not allowed to quit a game 5 minutes before the game started.

9 Judging and Awards

9.1 Technical Interview

- 9.1.1 It is compulsory for all teams to attend the technical interview. Teams should read the interview score sheet for reference while preparing for their interview.
- 9.1.2 During the interview, students will be asked about their preparation efforts. Teams are required to give a 5-minute presentation based on the **Learning Journal** (refer to section 3.1) and present their poster during the interview. This should be entirely technical based presentation.
- 9.1.3 Interviews will take place in English, if teams require a translator they should inform the local organizing committee by e-mail prior to the event to allow translators to be organized.
- 9.1.4 Teams may be asked to have a second interview after the Technical Challenge, Round Robin or Finals, if judges consider it is necessary. Teams may be asked to submit their source code for the round. The source code will not be shared with other teams without the team’s permission.

9.2 Technical Challenge

- 9.2.1 The Technical Challenge is to evaluate individual team’s capability in AI planning and coding capability. The Technical Challenge task will be announced onsite. Its format may be completely different from the traditional Rescue Simulation (former CoSpace) mission. Teams are required to submit the solution within 2 hours.
- 9.2.2 **During the programming period, members are not allowed to leave the team area. Teams are not allowed to consult mentors and other teams to solve the Technical Challenge task.**
- 9.2.3 The Technical Challenge result will be used as the evaluation criteria for the “winner of the round robin” (refer to section 9.4.1).

9.3 Friendship Tournament

- 9.3.1 A friendship tournament will be setup for teams that could not reach the quarter-finals. The minimum number of teams participating in the friendship tournament is 4.
- 9.3.2 Teams will draw lots to determine the team to play with. At the end of a match, the winning team must continue on to the next match. The losing team can modify the program and play again or withdraw its participation. The challenge will be carried out during the specific duration announced by the RCJ Rescue Organizing Committee onsite. The last survivor will be the winner.

9.4 Competition Scoring and Progression

9.4.1 Round Robin

The ranking of the Robin is determined by the Game Points for each team and the results from the technical challenge. The technical challenge is weighted by 30%, and the game points by 70%. With the total score of each team determined by:

$$\text{Score} = \frac{\text{Team's Game Points}}{\text{Highest Game Points Achieved in The Round Robin Group}} \times 70 + \frac{\text{Team's Average Tech Challenge Score}}{\text{Highest Tech Challenge Score}} \times 30$$

- If two teams gained the same result, the winner will be decided based on the technical challenge result.
- If the technical challenge results are still the same, the winner will be decided based on the total round robin points.
- If the total round robin points are still the same, the team with the higher points in WORLD_2 will be the winner.

9.4.2 Quarter-Finals, Semi-finals and Final

- The winner of the quarter-finals, semi-finals and final will be decided solely based on the quarter-/semi-/final game result.
- If match ends in a tie, teams will enter a re-match.

9.5 Awards

- 9.5.1 Depending on the number of teams entering the competition, there will be awards in the form of trophies and certificates. The Organizing Committee can adjust the award type (trophy or certificate) depending on the number of teams involved. These awards list will be released closer to the international event.

Part 3: Individual Team Challenge (Advanced Level)

10 Game Description

10.1 Game process

10.1.1 A game lasts 8 minutes, with two teams competing in one game. A game consists of WORLD_1 and WORLD_2. A team has one robot in each WORLD as shown in Figure 7.

- a) ROBOT_1 can spend between 3-5 minutes in WORLD_1.
- b) ROBOT_2 will spend the remaining time in WORLD_2.

10.1.2 A team must program ROBOT_1 and ROBOT_2 to navigate and collect objects in WORLD_1 and WORLD_2. A team must end ROBOT_1 and activate the ROBOT_2 when transferring from WORLD_1 to WORLD_2 (refer section 10.3).

10.1.3 Only one robot can move at any one time. When ROBOT_1 moves in WORLD_1, ROBOT_2 must be in standby mode. When the ROBOT_2 is activated, ROBOT_1 stops until the end of the game.

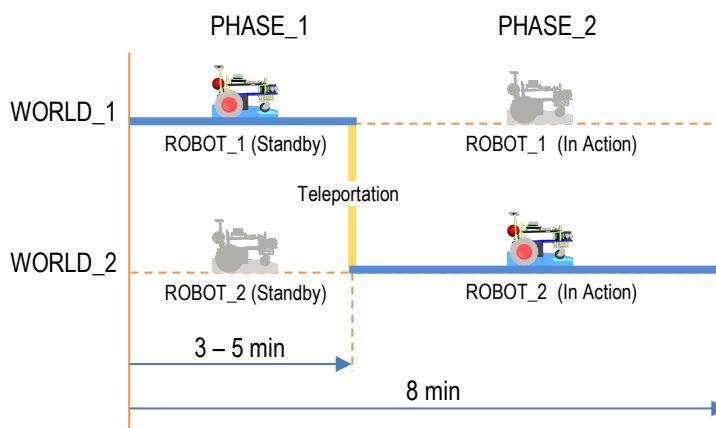


Figure 7: Rescue Simulation (former CoSpace) Game Process

10.2 Phase_1

10.2.1 A game begins with ROBOT_1 navigating in WORLD_1.

10.2.2 In the WORLD_1, ROBOT_1 searches for 3 types of objects, RED, CYAN, and BLACK objects. ROBOT_1 has to collect the objects and then deposit them in the collection box to receive points. It cannot collect more than 6 objects at any one time without depositing them in the collection box.

10.2.3 Bonus points will be awarded for every set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the collection box (refer to section 13.4.4).

10.3 Teleportation

Teleportation means ending ROBOT_1's movement in WORLD_1 and activating the team's ROBOT_2 in WORLD_2.

10.3.1 A team needs to teleport their ROBOT_1 at any time after 3 minutes but before the first 5 minutes passed whilst ending the ROBOT_1's movement.

10.3.2 Teleportation within the first 3 minutes is invalid.

10.3.3 If a team fails to teleport by the end of the first 5 minutes, ROBOT_2 will be activated by the CoSpace server automatically (refer to section 13.4.5).

10.4 Phase_2

10.4.1 In WORLD_2, ROBOT_2 searches for 5 types of objects, RED, CYAN, BLACK, SUPER and SUPER+ objects. ROBOT_2 has to collect the objects and deposit them in the collection box to receive points. It cannot collect more than 6 objects at any one time without depositing them in the collection box.

10.4.2 SUPER or SUPER+ objects will be created upon every set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the collection box (refer to section 12.5.1).

10.5 Competition Setup

10.5.1 Individual Team Challenge: WORLD_1 and WORLD_2 are virtual. ROBOT_1 and ROBOT_2 are virtual (Refer to section 21.2).

11 Robot

11.1.1 In the individual team challenge of the Advanced level, teams are only required to program the virtual robot for both WORLD_1 and WORLD_2. The configuration of virtual robot is shown as in section 20.

11.1.2 While the robot is in WORLD_2, the CoSpace Server will send the coordinates of RED and BLUE robots to both teams. Figure 8 shows an example where the virtual robot is located at position (180cm, 197cm).

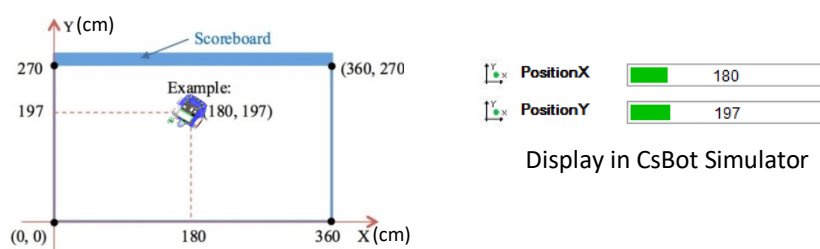


Figure 8: X & Y coordinate system for robot in WORLD_2

11.1.3 Virtual/real robots must be controlled autonomously.

12 Arena

12.1 Layout

12.1.1 The dimensions

- WORLD_1: 180cm x 240cm
- WORLD_2: 270cm x 360cm

12.1.2 Boundary:

- WORLD_1: It is enclosed by a wall of height 15 cm.
- WORLD_2: There will be no boundary for WORLD_2. Teams are required to keep the robot within the virtual arena based on the dimensions given. There will be an indication of the boundary for audience.

12.1.3 WORLD_1 and WORLD_2 are a 3D simulated virtual environment.

- WORLD_1 contains objects, **static obstacles**, traps, markers, special zones and collection boxes.
- WORLD_2 contain objects, **static obstacles**, **moving obstacles**, **random generated obstacles**, traps, markers, special zones, collection boxes, swamplands, signal block zones.

12.1.4 **Section 21.2** shows the sample layout of WORLD_1 and WORLD_2.

12.2 Markers, Obstacles, Special Zones, Traps, and Collection Boxes

12.2.1 **Markers.** There may be some markers in the **WORLD_1 and WORLD_2**. The makers can be used to help the **ROBOT_1 and ROBOT_2** for its localization, guidance, etc. The minimum size of the marker is 2cm x 2cm. The colour and shape of the marker is not fixed.

12.2.2 **Obstacles.** There are **three** types of obstacles – **static obstacles**, moving obstacles and **randomly generated obstacles**.

- **Static obstacles** are placed in both **WORLD_1 and WORLD_2**. It can be of any size, any shape with the minimum dimensions of 10cm x10cm.
- Moving obstacles are only placed in the **WORLD_2**. They will move around randomly (random position and random speed). The coordinates of the moving obstacles will not be provided. The size and shape of the moving obstacles are not fixed. They can be moving robots, aliens, etc.
- **Randomly generated obstacles will appear and disappear randomly in the WORLD_2. They can be any shape. The maximum size of each randomly generated obstacle is 30cm x 30cm. The following information will be provided to teams regarding the randomly generated obstacles:**
 - a) **The appearance and disappearance of the objects**
 - b) **The duration of presence of the objects**
 - c) **The center coordinates of the objects.**

12.2.3 **Special Zones.** Certain areas in the **WORLD_1 and WORLD_2** world are designated as special zones. RED, CYAN and BLACK objects collected in these areas are worth double points. The special zone is blue in colour as shown in figure 9. The special zones have a minimum size of 30cm x 30cm. The shape of the special zone is not fixed.

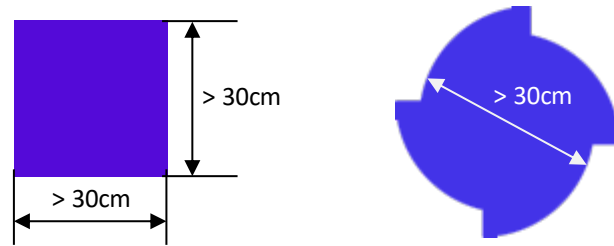


Figure 9: Sample of Special

12.2.4 **Traps** are surrounded by a yellow boundary (warning area) as shown in figure 10. The minimum size of the trap is 10cm x 10cm. The traps can be any colour. The shape of traps is not fixed. If a robot goes over a trap it will lose any objects it is currently carrying.

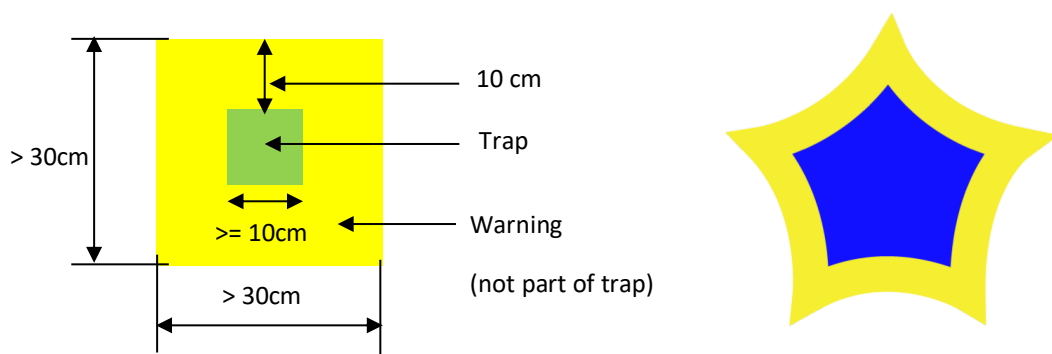


Figure 10: Sample of Traps

12.2.5 Figure 11 shows the **object collection box**. The collection box is ORANGE in colour. The dimensions of the deposit box is about 30 x 30 cm. The collection box can be any shape.

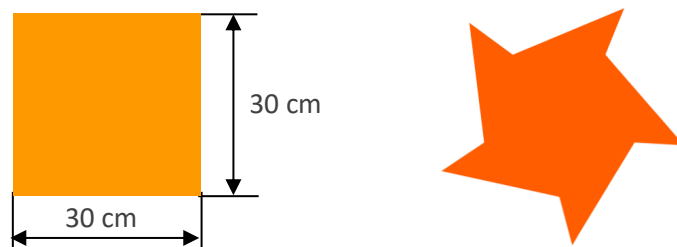


Figure 11: Sample of object collection boxes

12.3 Swampland (WORLD_2 Only)

12.3.1 The **swampland** is grey colour as shown in figure 12. The swampland can be any size bigger than 30cm x 30cm. The shape of the swamplands is not fixed.

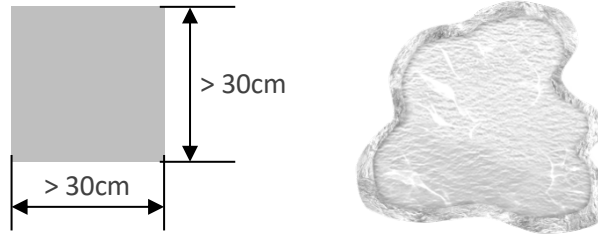


Figure 12: Sample of Swamplands

12.4 Signal Block Zone (WORLD_2 Only)

12.4.1 In the WORLD_2, there will be Signal Block Zones. When a robot enters the signal block zone, its coordinates information will be blocked, meaning the robot will receive PositionX = 0 and PositionY = 0.

12.4.2 The Signal Block Zones are randomly created by the CoSpace server. They will be generated once the field is launched. The location of the Signal Block Zones will not be changed throughout the entire game period.

12.4.3 There are 3 Signal Block Zones in the WORLD_2.

12.5 Objects

12.5.1 There are THREE types of objects, RED, CYAN, and BLACK located randomly throughout the course. Each type of objects worth different value (refer to section 13.4.2). The colour, shape, and size of objects is fixed. They are square or round shape in general.

- **Shape:** The shape of the objects will be any one of the followings. There might be different shapes of objects in a map.

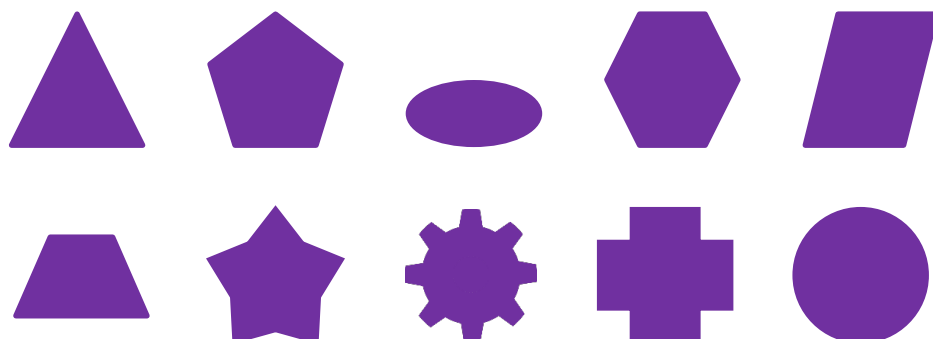


Figure 13: Objects (Advanced Level) - Shape

- **Size:** the inscribed circle for the 3 types object are:

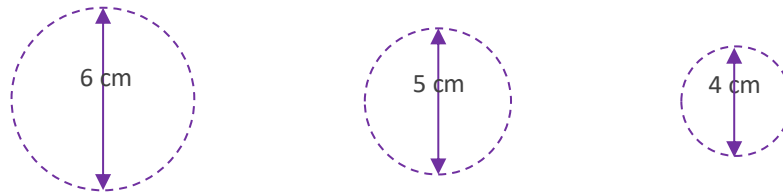


Figure 14: Objects (Advanced Level) - Size

- **Colour:** the colour of the objects will be in the RED/ CYAN categories or BLACK.

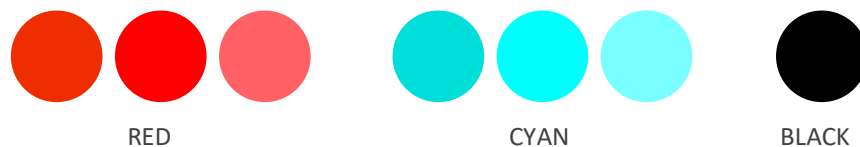


Figure 15: Objects (Advanced Level) - Colour

12.6 SUPER and SUPER+ Objects (WORLD_2 Only)

12.6.1 Creation of SUPER and SUPER+ objects

- ONE SUPER Object will be generated for every ONE set of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to Collection Box in the WORLD_2 (refer to section 13.4.3).
- ONE SUPER+ Object will be generated for every TWO sets of RED, CYAN and BLACK objects collected and deposited successfully in one single trip to the Collection Box in the WORLD_2.
- The SUPER or SUPER+ objects generated by BLUE team can only be collected by the BLUE team itself. The SUPER or SUPER+ objects generated by RED team can only be collected by the RED team itself.

12.6.2 Size, colour and shape of SUPER and SUPER+ objects

The SUPER and SUPER+ objects are about 5cm in diameter. They are circular in shape and purple in colour.

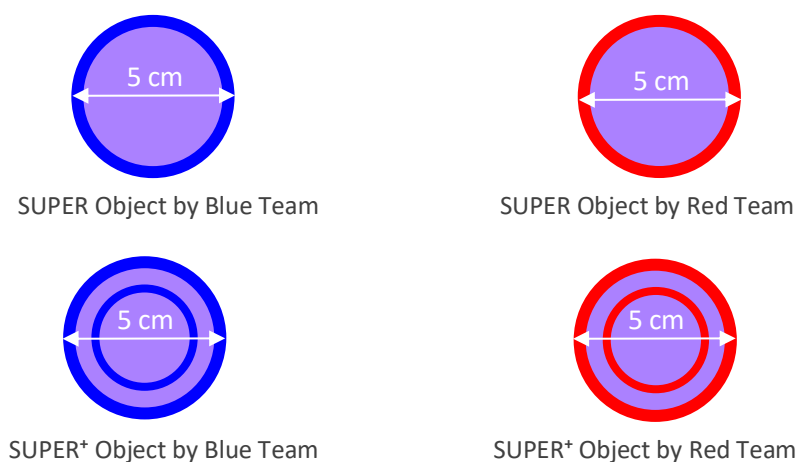


Figure 16: SUPER and SUPER+ objects

12.6.3 Placement of SUPER and SUPER+ objects

The CoSpace server will send the coordinates (X, Y) of the SUPER or SUPER+ objects to the respective team upon SUPER or SUPER+ objects' creation. The details, such as SUPER and SUPER+ objects notification and the coordinates, are described in the Rescue CoSpace Simulator user guide.

13 Gameplay

13.1 Map Release (Regional Event)

13.1.1 The layout (the maps) of WORLD_1 and WORLD_2 will be released to teams prior to the competition (typically approximately two hours beforehand). This allows teams to **design**/tailor their program and strategy for the specific field.

13.1.2 It is suggested that full layout of WORLD_2 to be used in the regional or super-regional events.

13.2 Map Release (World Championship)

13.2.1 The layout (the maps) of WORLD_1 will be released to teams prior to the competition (typically approximately two hours beforehand). This allows teams to **design**/tailor their program and strategy for the specific field.

13.2.2 The full layout of WORLD_2 will only be installed on the game station. It will not be released to teams prior to the competition. However, the indication of collection boxes, objects, swam zones and partial layout etc. will be released to teams. This is to encourage the development of increasingly autonomous searching strategies and also for teams to perform mapping. Section 22 gives an example of the full layout, partial layout, object distribution, and element table of WORLD_2.

13.3 Game Procedure

13.3.1 A referee is an official who receives and uploads teams' programs as well as runs the games.

13.3.2 At the end of each programming period:

- a) The chief judge will announce the time for program submission in the competition hall.
- b) 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.

13.3.3 Five minutes before each game:

- a) Team captains must report to the referee at the respective game stations.
- b) The OC determines whether it is possible to change the AI submitted by the team. If the OC determines that a delay in the schedule occurs, the team cannot change the AI.

13.3.4 Three minutes after the scheduled game time:

If a team has not arrived at the game station 3 minutes after the scheduled game time, the team will forfeit the game. The opponent will gain 500 points and be declared as the winner. Kindly note that the scheduled game time might be delayed.

13.3.5 Pre-match Meeting:

Each team will be assigned a team colour (BLUE or RED). At the start of the game, the referee will toss a coin. The result determines the teams' colour.

13.3.6 Start of Play:

- a) The referee will upload the programs to the CoSpace server, place the team's robot in the starting point in the virtual world and start the virtual game.
- b) It is the team captain's responsibility to ensure the correct program is uploaded.
- c) Team captains must be present during the full length of the game.

13.4 Scoring

13.4.1 A team will be given 100 points at the beginning of each game.

13.4.2 Collecting objects

- a) A team will gain points by collecting the objects.

To indicate that a robot has collected an object, it must stop and flash the LED for 3 seconds when any one of the colour sensor has detected the object.

Object Type	Points in WORLD_1 (Virtual)		Points in WORLD_2 (Virtual)	
	Regular Zone	Special Zone	Regular Zone	Special Zone
RED	10	20	10	20
CYAN	15	30	15	30
BLACK	20	40	20	40
SUPER	NA		90	90
SUPER*	NA		180	180

- b) A robot cannot collect more than 6 objects at any one time without placing them in the collection box. Objects in the virtual world will disappear after they are collected.

13.4.3 Depositing objects

When a robot deposits objects successfully, the points of the objects deposited will be doubled. “Robot deposits objects successful” means:

- a) A robot must stop inside the collection box with the LED steady ON for 3 seconds to indicate the depositing process;

A robot is only considered to be in the collection box when both colour sensors detect the collection box (both colour sensors are in the collection box).

- b) The robot will exit the collection box autonomously after deposition (both colour sensors are out of the collection box).

13.4.4 Bonus points (WORLD_1 Only)

- a) For every ONE set of RED, CYAN and BLACK objects collected and deposited successfully (in one single trip to the collection box) in WORLD_1, 90 bonus points will be rewarded. There will be no SUPER objects generated in WORLD_1.
- b) For every TWO sets of RED, CYAN and BLACK objects collected and deposited successfully (in one single trip to the collection box) in WORLD_1, 180 bonus points will be rewarded. There will be no SUPER+ objects generated in WORLD_1.

13.4.5 Communication and Teleportation

- a) For successful teleportation, teams will be given 100 bonus points. Teams can choose a location in WORLD_2 to which the robot will be teleported.
- b) For unsuccessful teleportation, the robot will be placed in WORLD_2 by the CoSpace server. No bonus will be given. Teams cannot choose the location in WORLD_2 to which the robot will be teleported.

13.4.6 Falling into a Trap

If a virtual/real robot falls into a trap, all objects that have been collected but not yet placed in the object collection box will disappear. Therefore, the points awarded for those objects collected will be deducted.

A virtual/real robot is considered to be in the trap if any one of the robot's colour sensor has detected the trap.

13.4.7 Falling into a Swamp (WORLD_2 Only)

If a robot falls into a swamp, the robot's speed will be reduced by 80% by the CoSpace server.

A virtual/real robot is considered to be in a swamp if any one of the colour sensor has detected the swamp.

13.4.8 Falling into a Signal Block Zone (WORLD_2 Only)

A virtual robot is considered to be in a signal block zone if the centre of the robot is within the zone. The centre coordinates is provided to teams by the CoSpace server.

13.4.9 Out of Boundary (WORLD_2 Only)

A virtual robot is considered out of boundary if the centre of the robot is outside the WORLD_2.

13.4.10 Game Points

After each match, following GAME POINTS will be given accordingly.

Game	GAME POINTS
Win	3
Tie	1
Loss	0

13.5 Human Interference

13.5.1 Except for a lack of progress, human interference (e.g. re-locate a real/virtual robot to any reset point) during the game is not allowed unless permitted by the referee. A violation of the rules may be penalized by disqualification from the tournament, the round or may result in loss of points as the discretion of the referee, officials, organizing committee or general chairs.

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

13.6 Lack of Progress

13.6.1 When a virtual robot is stuck for 10 seconds, the robot will be relocated to a different location close to where it was with different orientation by the CoSpace server.

In any case, including looping, the team captain can request to relocate the virtual robot to a different location. Upon team's request, the referee will call **"RELOCATE"** and the robot will be relocated to a different location but close to where it was with different orientation. However, the robot will be frozen for 10 seconds after relocation. The team can only call relocation up to 3 times in each game. The referee will keep track of the number of relocations requested.

13.6.2 A team may decide to stop a round early if the lack of progress cannot be resolved and 5 minutes have passed. In this case, the team captain must indicate to the referee the team's desire to terminate the game. The team will be awarded all points achieved.

13.7 Penalty

13.7.1 It is compulsory for teams to specify the team name in virtual games. 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 game if the team fails to add the team name for the second time in a virtual game.

13.7.2 If a robot is hit/attacked by another robot, the attacking robot will be separated from the attacked robot and repositioned at the same location with different orientation (if there is collision) and be frozen for 10 seconds. There will be no point deduction.

13.7.3 If two robots bump into each other, both robots will be separated from each other and repositioned at the same location with different orientation (if there is collision). Both robots will be frozen for 10 seconds. There will be no point deduction.

13.8 Re-match

In unforeseen circumstances, the game cannot be continued during the match, the RCJ Rescue Simulation Organising Committee will work with the Technical committee to evaluate the cause of the incident.

- a) If it is solely caused by a team, the opposing team will be declared as the winner of this game. Five hundred points will be awarded.
- b) If no conclusion can be drawn on the cause of the incident, the Referee will call a re-match.

13.9 Interruption of Game

13.9.1 In principle, a game will not be stopped during gameplay.

13.9.2 The referee can end a game when all objects have been collected by the robots.

13.9.3 The referee can pause a game when the game coordinator/referee needs to discuss an issue/problem with the OC/TC. The game will be called "time-out" in this case.

13.9.4 Teams are not allowed to quit a game 5 minutes before the game started.

14 Judging and Awards

14.1 Technical Interview

- 14.1.1 It is compulsory for all teams to attend the technical interview. Teams should read the interview score sheet for reference while preparing for their interview.
- 14.1.2 During the interview, students will be asked about their preparation efforts. Teams are required to give a 5-minute technical presentation based on the TDP (refer to section 3.2) and present their poster during the interview. This should be entirely technical based presentation.
- 14.1.3 Interviews will take place in English, if teams require a translator they should inform the local organizing committee by e-mail prior to the event to allow translators to be organized.
- 14.1.4 Teams may be asked to have a second interview after the Technical Challenge, Round Robin, or Finals, if judges consider it is necessary. Teams may be asked to submit their source code for the round. The source code will not be shared with other teams without the team's permission.

14.2 Technical Challenge

- 14.2.1 The Technical Challenge is to evaluate individual team's capability in AI planning and coding capability. The Technical Challenge task will be announced onsite. Its format may be completely different from the traditional Rescue Simulation (former CoSpace) mission. Teams are required to submit the solution within 2 hours.
- 14.2.2 It is compulsory for teams to take part in the Technical Challenge. During the programming period, members are not allowed to leave the team area.
- 14.2.3 All team members in the **Advanced Level** are required to attend the Technical Challenge. Each member will work on the task independently. Members are not allowed to consult mentors. Members from the same team are not allowed to discuss or share code among themselves. The average score will be considered as the team result.
- 14.2.4 The Technical Challenge result will be used as the evaluation criteria for the "winner of the round robin" (refer to section 14.5.1).

14.3 Best Strategy Challenge (World Championship Only)

- 14.3.1 **In the World Championship, a Best Strategy Challenge may be setup.** However, the Best Strategy Challenge is not compulsory for every member. Only students aiming for the Best Strategy Award are required to sit in the Challenge.
- 14.3.2 Team members can only take part in the challenge as individual candidates. Each candidate has to work on the task independently. No discussion or sharing code with any member is allowed.
- 14.3.3 The task will be announced onsite. Candidates will have two and half-hours to complete the task. During the programming period, candidates are not allowed to leave the team area.

14.4 Friendship Tournament

14.4.1 A friendship tournament will be setup for teams that could not reach the quarter-finals. The minimum number of teams participating in the friendship tournament is 4.

14.4.2 Teams will draw lots to determine the team to play with. At the end of a match, the winning team must continue on to the next match. The losing team can modify the program and play again or withdraw its participation. The challenge will be carried out during the specific duration announced by the RCJ Rescue Organizing Committee onsite. The last survivor will be the winner.

14.5 Competition Scoring and Progression

14.5.1 Round Robin

The ranking of the Robin is determined by the Game Points for each team and the results from the technical challenge. The technical challenge is weighted by 30%, and the game points by 70%. With the total score of each team determined by:

$$\text{Score} = \frac{\text{Team's Game Points}}{\text{Highest Game Points Achieved in The Round Robin Group}} \times 70 \\ + \frac{\text{Team's Average Tech Challenge Score}}{\text{Highest Tech Challenge Score}} \times 30$$

- If two teams gained the same result, the winner will be decided based on the technical challenge result.
- If the technical challenge results are still the same, the winner will be decided based on the total round robin points.
- If the total round robin points are still the same, the team with the higher points in WORLD_2 will be the winner.

14.5.2 Quarter-Finals, Semi-finals and Final

- The winner of the quarter-finals, semi-finals and final will be decided solely based on the quarter-/semi-/final game result.
- If the match is a tie, teams will enter a re-match.

14.6 Awards

14.6.1 Depending on the number of teams entering the competition, there will be awards in the form of trophies and certificates. The Organizing Committee can adjust the award type (trophy or certificate) depending on the number of teams involved. These awards list will be released closer to the international event.

Part 4: SuperTeam Challenge (World Championship Only)

15 SuperTeam Rules

SuperTeams will be formed of at least two teams per SuperTeam. The rules from the individual competition hold unless overridden by the following SuperTeam Rules. In RCJ2020 the organizer will provide the real robots (standard platform) during the international competition. ZigBee communication protocol is used in the Rescue CoSpace robot platform for establishing the real/virtual robot communication. Self-built robots are not allowed. The game process will be the same as the individual team games

15.1 Mission

In SuperTeam Challenge, both teams have to develop and program appropriate strategies for both real and virtual autonomous robots to navigate through the real and virtual worlds to collect objects. Teams are required to cooperate, communicate using self-defined protocol, and work together to collect objects while avoiding all types of obstacles, swamplands, signal block zones, and traps. The sum of both teams' individual score will be the score of the SuperTeam.

16 The Team and Robots

Each SuperTeam consists at least two individual teams. Each SuperTeam has 1 real robot (ROBOT_1) and 2 virtual robots (ROBOT_2_RED and ROBOT_2_BLUE). ROBOT_2_RED and ROBOT_2_BLUE will be programmed by two individual teams respectively.

17 Game Description

17.1 Game process

17.1.1 A game begins with:-

- The ROBOT_2_RED (virtual) navigating in the WORLD_2 (virtual).
- The ROBOT_1 (real) working on rescue mission in WORLD_1 (real).

17.1.2 The SuperTeam game lasts for 8 minutes. Figure 17 shows the game process.

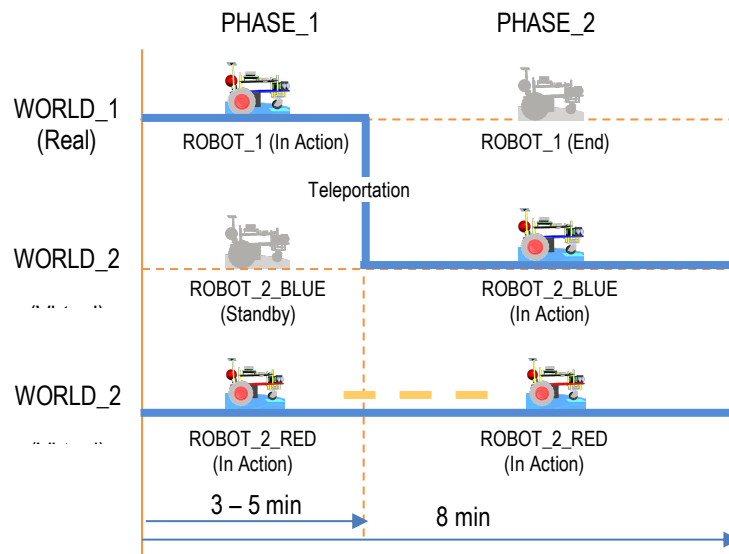


Figure 17: Rescue Simulation (former CoSpace) Game Process

17.2 Phase_1

17.2.1 The ROBOT_1 works on rescue mission in WORLD_1 (real) while competing with another team's real robot. The ROBOT_1 will only stay in WORLD_1 for 3 – 5 minutes.

17.2.2 The ROBOT_2_RED can only navigate in the WORLD_2 to gather the information of WORLD_2 and mapping. The ROBOT_2_RED is not allowed to collect and deposit objects. The ROBOT_2_RED will stay in WORLD_2 for 8 minutes. The ROBOT_2_RED can only collect and deposit objects in Phase_2.

17.3 Teleportation:

17.3.1 A team needs to teleport their ROBOT_1 at any time after 3 minutes but before the first 5 minutes passed whilst ending the ROBOT_1's movement. Team will gain 100 bonus points for a successful teleportation.

17.3.2 Teleportation within the first 3 minutes is invalid.

17.3.3 If a team fails to teleport by the end of the first 5 minutes, ROBOT_2_BLUE will be activated by the CoSpace server automatically. No bonus points will be given.

17.4 Phase 2:

17.4.1 Both ROBOT_2_RED and ROBOT_2_BLUE work on the virtual field for mapping, collecting objects and depositing objects.

17.4.2 ROBOT_2_RED and ROBOT_2_BLUE are able to communicate via a self-defined protocol and work collaboratively on the rescue mission.

18 Arena

18.1 WORLD_1 (Real World)

18.1.1 The floor of WORLD_1 is generally white. The floor may be either smooth or textured. Section 23 shows the building instructions.

18.1.2 The real world will be placed so that the floor is level.

18.1.3 WORLD_1 will be enclosed by a wall of height 15cm.

18.1.4 The WORLD_1 (real world) contains objects, static obstacles, traps, markers, collection boxes and special zones.

18.1.5 Objects in the real world will NOT disappear after they are collected. It is the team's responsibility to program their robot such that it moves away from the same real object and search for others. Collecting the same objects consecutively will not be counted.

18.1.6 The lighting condition for the real worlds could be varied. Teams must be able to perform calibration in order to complete the mission.

18.1.7 For teams using real robots, please note that picture taking by spectators might create IR and visible light into the real-world setup and to the real robots. Whilst efforts will be made to limit this, it is very difficult for organizers to strictly control factors outside of the real world. Teams are strongly encouraged to program their real robots so that sudden changes (e.g. camera flash) do not cause major problems.

18.2 WORLD_2 (Virtual World)

18.2.1 The WORLD_2 will be the same as the WORLD_2 of the Advanced Level (Refer to section 12). Section 21.3 shows the sample layout of WORLD_1 and WORLD_2 for the SuperTeam Challenges.

18.2.1 The full layout of WORLD_2 will be installed on the game station. Only the partial map will be released to SuperTeams. (Refer to section 13.2.2 and section 22).

19 Game Play

Please refer to section 13 for the game play procedure.

19.1 Scoring

19.1.1 Scores allocated to objects in the WORLD_1 (real) and WORLD_2 (virtual) are as follows.

Object Type	Points in WORLD_1 (Real)		Points in WORLD_2 (Virtual)	
	Regular Zone	Special Zone	Regular Zone	Special Zone
RED	20	40	10	20
CYAN	30	60	15	30
BLACK	40	80	20	40
SUPER	NA		90	90
SUPER+	NA		180	180

19.1.2 Each individual team (part of SuperTeam) can collect all SUPER or SUPER+ objects generated by both RED robot and BLUE robot.

19.1.3 The score of a SuperTeam will be the total score of individual teams.

19.2 Lack of Progress

19.2.1 In the SuperTeam Challenge, the team captain will need to request for relocation for the following case:

- a) Real robot is stuck
- b) Real robot is looping
- c) Real robot is not performing well.

Each SuperTeam can call relocation up to 3 times in the real game.

Each SuperTeam can also call relocation up to 3 times (counted separately) in the virtual game as described in section 13.6.1. The referee will keep track of the number of relocations requested.

19.2.2 Teams are not allowed to stop a round early.

19.3 Winner of SuperTeam Competition

The winner of the SuperTeam competition will be decided solely based on the game result.