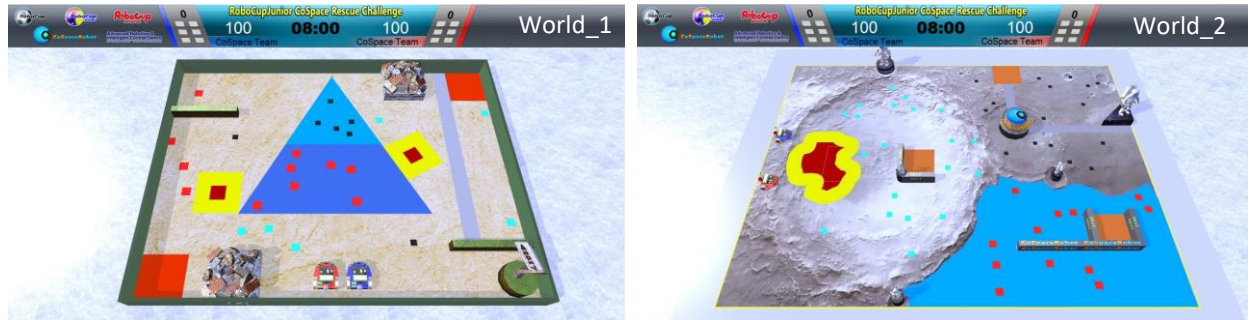# RoboCupJunior Simulation (former CoSpace) – Rules 2021

Please read through the RoboCupJunior General Rules before proceeding on with this rule, as it is the premise for all rules. These are the official rules for RoboCupJunior Rescue Simulation 2021. They are released by the RoboCupJunior Rescue Technical Committee (TC). The English rules have priority over any translations. Additions from the 2020 rules are highlighted by a "**NEW**" indicator in front of the section/subsection/subsubsection, dependent on the change. Grammatical corrections, rearrangements of rules, and minor clarifications will not be indicated. It is the responsibility of the teams to have read and understood the official rules.

Summary of notable changes to the rules

- Removal of the Preliminary level. All of the individual competition will be performed identically to the former Advanced level.
- Removal of the use of real robots.
- Teams are not allowed to change their AI/program after submission for each round.

Preface

In Rescue Simulation, teams have to develop and program appropriate strategies for virtual and autonomous robots to navigate through the virtual world to collect objects while competing with another team's robot that is searching and collecting objects in the same virtual world. All robots will refer to virtual robots and worlds will refer to virtual worlds.

Official RoboCupJunior site: https://junior.robocup.org/rescue/

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

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

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:-
   ● **Individual Challenge**
   ● **SuperTeam Challenge**

The **Rescue CoSpace Simulator** can be downloaded at https://www.cospacerobot.org/download/cospace-rescue-download. 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 https://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 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 Interview Score Sheet as reference while preparing for the technical interview.

- *Technical Challenge:* The Technical Challenge is compulsory for all teams. Its purpose is to evaluate an individual team's capability in AI planning and coding. Technical Challenge tasks will be announced on site. Its 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 the 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. Each team is allotted to a RED/BLUE team using a RED/BLUE robot.

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 on-site. Students will have two and half hours to complete the task.

SuperTeam Challenge:

At the international RoboCupJunior Rescue Simulation 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 the individual team's strength and work together to create a new AI to solve a new task. SuperTeams are encouraged to express their friendship and cooperation and demonstrate what they have learnt from each other. The SuperTeam Challenge is a special program for the international event and is not obligatory for regional events.

Contents

Part A: General Rules for Rescue Simulation

1. Team

1.1 Team

1.1.1 All team members must comply with the stipulated age and team size as stated on the RCJ website https://junior.robocup.org/robocupjunior-general-rules/.

1.1.2 Every team member needs to carry out a technical role for the team (strategy planning, programming, etc.), this should be identified at the registration. Each member will need to explain their technical role and should be prepared to answer questions about the technical aspects of their involvement in preparing the Rescue Simulation (former CoSpace) Challenge.

1.1.3 Teams should be responsible for checking all updated information (schedules, meetings, announcements, etc.) during the event.

1.1.4 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 gameplay, the referee will ask the captain to sign the score sheet. The captain should be given a maximum of 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 in the score sheet and sign it.

2.2 Rule Clarification

2.2.1 It is the team's responsibility to verify at the official RoboCupJunior website the latest version of the rules prior to the competition. It is also required for teams to check the official RoboCupJunior forum for any rule clarification/corrections. Teams should use this platform for queries to be answered by the International RoboCupJunior Rescue Technical Committee.

2.2.2 If necessary during a competition, a rule clarification could be made by members of the RoboCupJunior Rescue Technical Committee (TC) and Organizing Committee (OC).

2.3 Special Circumstances

2.3.1 In special circumstances, such as unforeseen problems with the software platform, rules may be modified by the RoboCupJunior Rescue Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, if necessary 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 understood that they agreed and were aware of the changes.

3. Documentation

3.1 Team Description Paper

3.1.1 The Team Description Paper (TDP) submission is expected for the world championships and may be useful for regional or super-regional events.

3.1.2 Each team is required to submit a TDP to the Rescue 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 interviewed to help establish the authenticity of a team's performance.

3.1.3 The format of TDP can be found in Appendix D. Teams can also download it from https://junior.robocup.org/rescue-simulation-league-former-cospace-league/.

3.2 Poster

3.2.1 Teams will be given some public space to display their poster. The size of the poster should be no larger than A1 format (60 x 84 cm). The poster should be brought to the technical interview. After the interview, the poster should be displayed on the designated location.

3.2.2 The purpose of the poster is to explain the technology used in the robots. It must include the following elements:

- 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 the competition/setup area will be immediately 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 an AI 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 other 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 equally to all participants at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

4.2.7　Non-team members (teachers, parents and other family, 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 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. This further supports the mission of RoboCupJunior as an educational initiative.

4.3.2　Any developments may be published on the RoboCupJunior website after the event.

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 volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and, most importantly, fun.

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

Part B: Individual Team Challenge

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.

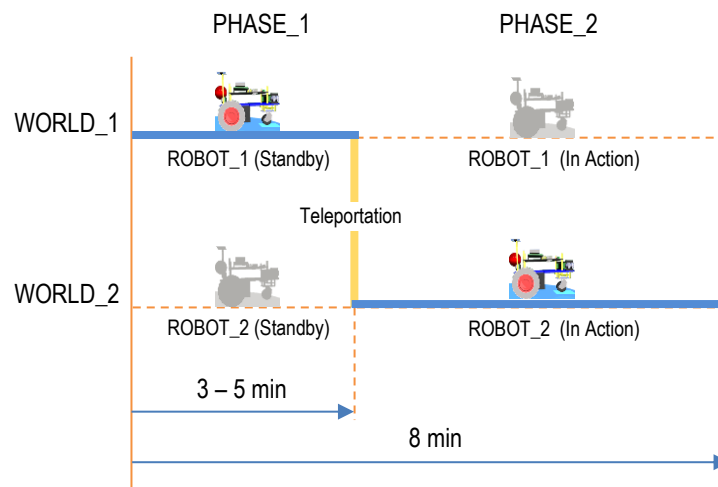Figure 1: Rescue Simulation Game Process

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. 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.

5.3 Teleportation

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

5.3.2 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.

5.3.3 Teleportation within the first 3 minutes is invalid.

5.3.4 If a team fails to teleport by the end of the first 5 minutes, ROBOT_2 will be activated by the CoSpace server automatically.

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 7.6.1).

6. Robot

6.1 Robot

6.1.1 In the individual team challenge, teams are required to program the robot for both WORLD_1 and WORLD_2. The configuration of the robot is shown as in APPENDIX A.

6.1.2 While the robot is in WORLD_2, the CoSpace Server will send the coordinates of RED and BLUE robots to both teams. Figure 2 shows an example where the robot is located at position (180cm, 197cm).
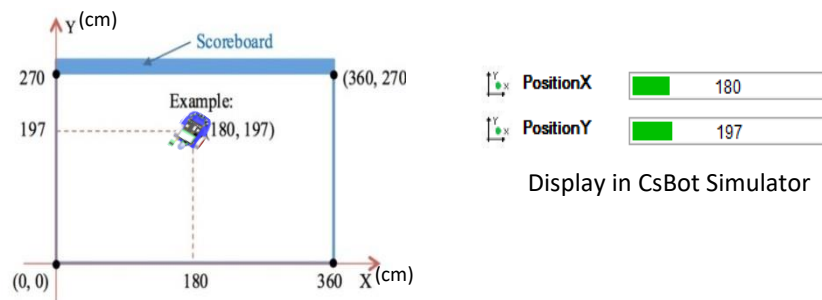

Figure 2: X & Y coordinate system for robot in WORLD_2

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

7.1.3   WORLD_1 and WORLD_2 are 3D simulated environments.

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

7.1.4   APPENDIX B 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

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. They can vary in size and shape with the minimum dimensions of 10cm x 10cm.
- Moving obstacles are only placed in 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 dimensions of each randomly generated obstacle are 30cm x 30cm. The following information will be provided to teams regarding the randomly generated obstacles:

  1.   The appearance and disappearance of the objects
  2.   The duration of presence of the objects
  3.   The center coordinates of the objects.

7.2.3   Special Zones

Certain areas in the WORLD_1 and WORLD_2 worlds 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 3. The special zones have a minimum size of 30cm x 30cm. The shape of the special zone is not fixed.
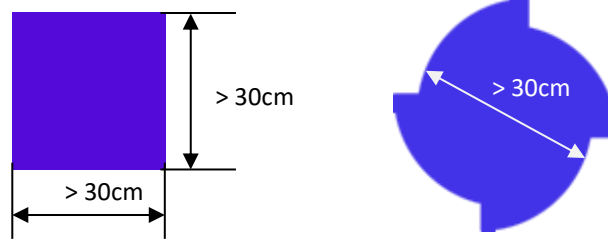
Figure 3: Sample of Special Zones

7.2.4 Traps

Traps are surrounded by a yellow boundary (warning area) as shown in figure 4. The minimum dimension 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.
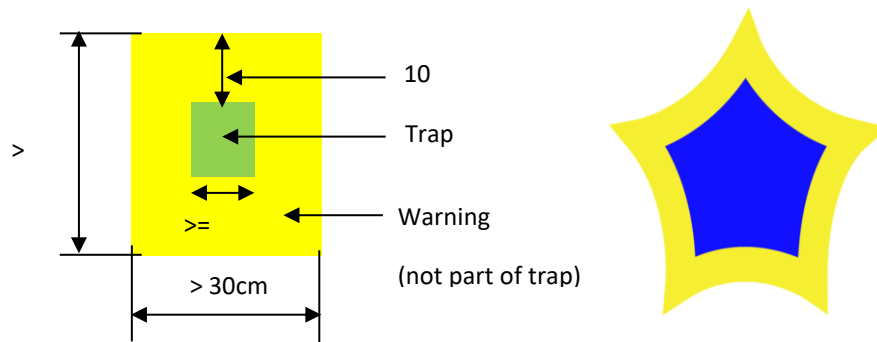

Figure 4: Sample of Traps

7.2.5 Object collection box

The collection box shown in figure 5 is ORANGE in colour. The dimensions of the deposit box are approximately 30 x 30 cm. The collection box can be any shape.
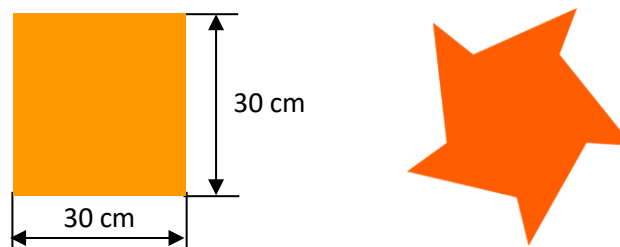
Figure 5: Sample of object collection boxes

7.3 Swampland (WORLD_2 Only)

7.3.1   The swampland is grey colour as shown in figure 6. The swampland can be any size bigger than 30cm x 30cm. The shape of the swamplands is not fixed.
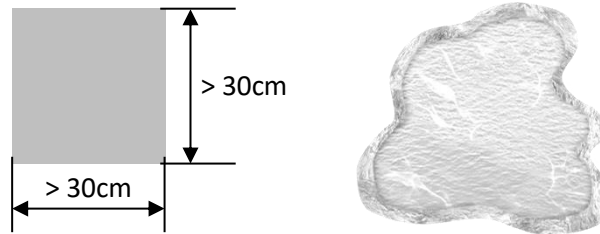

Figure 6: Sample of Swamplands

7.4 Signal Block Zone (WORLD_2 Only)

7.4.1   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.

7.4.2   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.

7.4.3   There are 3 Signal Block Zones in WORLD_2.

7.5 Objects

7.5.1   There are THREE types of objects, RED, CYAN, and BLACK located randomly throughout the course. Each type of object worth different points. The colour, shape, and size of objects is fixed. They are generally square or round-shaped.

- **Shape**: The shape of the objects will be any of the following shown in figure 7. There might be different shapes of objects in a map.
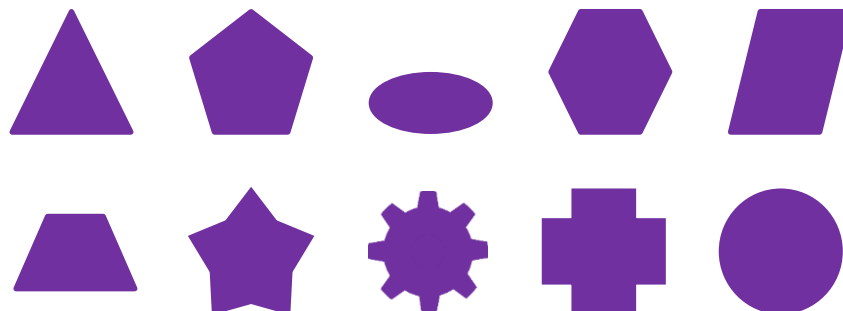

Figure 7: Objects - Shape

- **Size**: the inscribed circle for the 3 types of objects is as shown in figure 8.
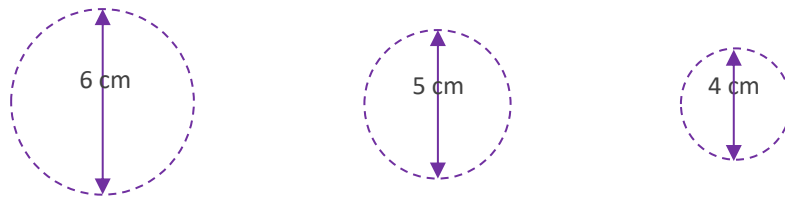

6 cm   5 cm   4 cm

Figure 8: Objects - Size

- **Colour**: the colour of the objects will be in the RED/ CYAN categories or BLACK shown in figure 9.

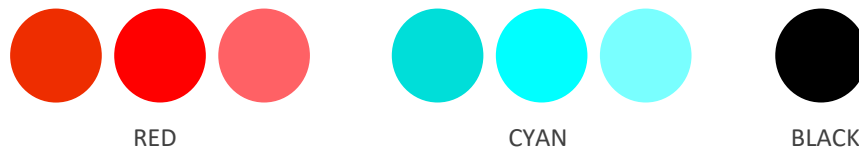

RED   CYAN   BLACK

Figure 9: Objects - Colour

7.6 SUPER and SUPER+ Objects (WORLD_2 Only)

7.6.1   Creation of SUPER and SUPER+ objects

a)   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.

b)   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.

c)   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

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

The SUPER and SUPER+ objects are approximately 5cm in diameter. They are circular in shape and purple in colour shown in figure 10.
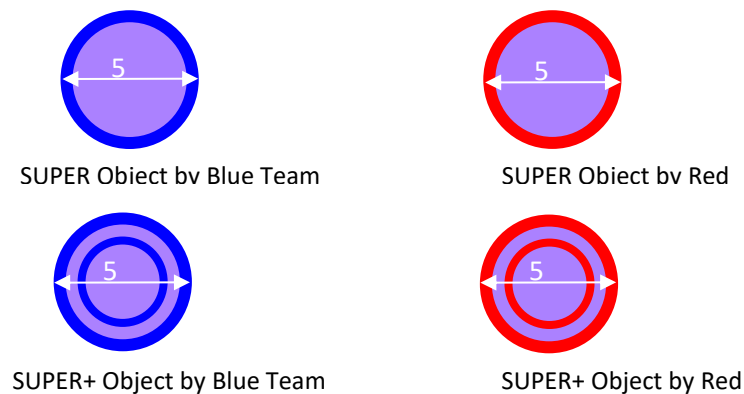

SUPER Obiect bv Blue Team   SUPER Obiect bv Red

SUPER+ Object by Blue Team   SUPER+ Object by Red

Figure 10: SUPER and SUPER+ objects

7.6.3 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.

8. Gameplay

8.1 Map Release (Regional Event)

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.

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

8.2 Map Release (World Championship)

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

8.2.2 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, swamp 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.

APPENDIX C gives an example of the full layout, partial layout, object distribution, and element table of WORLD_2.

8.3 Game Procedure

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

8.3.2 At the end of each programming period

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

b) Each team must submit their AI strategy which is created during the programming period to the chief judge.

8.3.3 5 minutes before each game

Team captains must report to the referee at the respective game stations.

8.3.4 3 minutes after the scheduled game time

If a team has not arrived at the game station and 3 minutes have elapsed, 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.

8.3.5 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.

8.3.6 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 world and start of the 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.

8.4 Scoring

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

8.4.2 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 sensors has detected the object.

Object Type	Points in WORLD_1		Points in WORLD_2	
	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 worlds will disappear after they are collected.

8.4.3 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).

8.4.4 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.

8.4.5 Communication and Teleportation

a) For successful teleportation, teams will be given 100 bonus points. Teams can choose a location in WORLD_2 that the robot will be teleported to.

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 that the robot will be teleported to.

8.4.6 Falling into a Trap

If a 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 robot is considered to be in the trap if any one of the robot's colour sensors has detected the trap.

8.4.7 Falling into a Swampland (WORLD_2 Only)

If a robot falls into a swampland, the robot's speed will be reduced by 80% by the CoSpace server. A robot is considered to be in a swampland if any one of the colour sensors has detected the swampland.

8.4.8 Falling into a Signal Block Zone (WORLD_2 Only)

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

8.4.9 Out of Boundary (WORLD_2 Only)

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

8.4.10 Game Points

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

Game	GAME POINTS
Win	3
Tie	1
Loss	0

8.5 Human Interference

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

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

8.6 Lack of Progress

8.6.1   When a 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 robot to a different location. Upon the 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.

8.6.2   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.

8.7 Penalty

8.7.1   It is compulsory for teams to specify the team name in games. Teams will be given a verbal warning if they failed to do so 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 game.

8.7.2   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.

8.7.3   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.

8.8 Re-match

In case of unforeseen circumstances in which the game cannot be continued, the OC will work with the TC to evaluate the cause of the incident.

a)   If it is solely caused by a team, the opponent team will be declared as the winner of this game. 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.

8.9 Interruption of Game

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

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

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

8.9.4   Teams are not allowed to quit a game 5 minutes before the game starts.

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 their interview.

9.1.2   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 3.1) and present their poster during the interview. This should be an entirely technically-based presentation.

9.1.3   Interviews will take place in English. If teams were to require a translator, they should inform the local organizing committee by email prior to the event.

9.1.4   Teams may be asked to have a second interview after the Technical Challenge, Round Robin or Finals, if judges consider it 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 consent.

9.2 Technical Challenge

9.2.1   The Technical Challenge is to evaluate an individual team's capability in AI planning and coding capability. The Technical Challenge task will be announced on site. 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   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.

9.2.3   All team members 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.

9.2.4   The Technical Challenge result will be used as the evaluation criteria for the "winner of the round robin" (refer to section 9.5).

9.3 Best Strategy Challenge (World Championship Only)

9.3.1   In the World Championship, a Best Strategy Challenge may be set up. 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.

9.3.2   Team members can only take part in the challenge as individual candidates. Each candidate has to work on the task independently. No discussion or code-sharing with any member is allowed.

9.3.3   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.

9.4 Friendship Tournament

9.4.1   A friendship tournament will be set up for teams that could not reach the quarter-finals. The minimum number of teams participating in the Friendship Tournament is 4.

9.4.2   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 OC onsite. The last survivor will be the winner.

9.5 Competition Scoring and Progression

9.5.1   Round Robin

The ranking of the Round 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:

$$Score = \frac{Team's\ Game\ Points}{Highest\ Game\ Points\ Achieved\ in\ The\ Round\ Robin\ Group} \times 70$$

$$+ \frac{Team's\ Average\ Tech\ Challenge\ Score}{Highest\ Tech\ Challenge\ Score} \times 30$$

- 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.

9.5.2 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 tied, teams will take part in a re-march to determine a winner.

9.6 Awards

9.6.1   Depending on the number of teams entering the competition, there will be awards in the form of trophies and certificates. The OC 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 C: SuperTeam Challenge (World Championship Only)

10. 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.

10.1 Mission

In the SuperTeam Challenge, both teams have to develop and program appropriate strategies for autonomous robots to navigate through the worlds to collect objects. Teams are required to cooperate, communicate using 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 scores will be the score of the SuperTeam.

11. The Team and Robots

Each SuperTeam consists of at least two individual teams. Each SuperTeam has 2 robots (ROBOT_RED and ROBOT_BLUE). ROBOT_RED and ROBOT_BLUE will be programmed by two individual teams respectively.

12. Game Description

12.1 Game process

12.1.1 A game begins with:-

- The ROBOT_1_BLUE working on a rescue mission in WORLD_1.
- The ROBOT_2_RED navigating in the WORLD_2 .

12.1.2 The SuperTeam game lasts for 8 minutes. Figure 11 shows the game process.
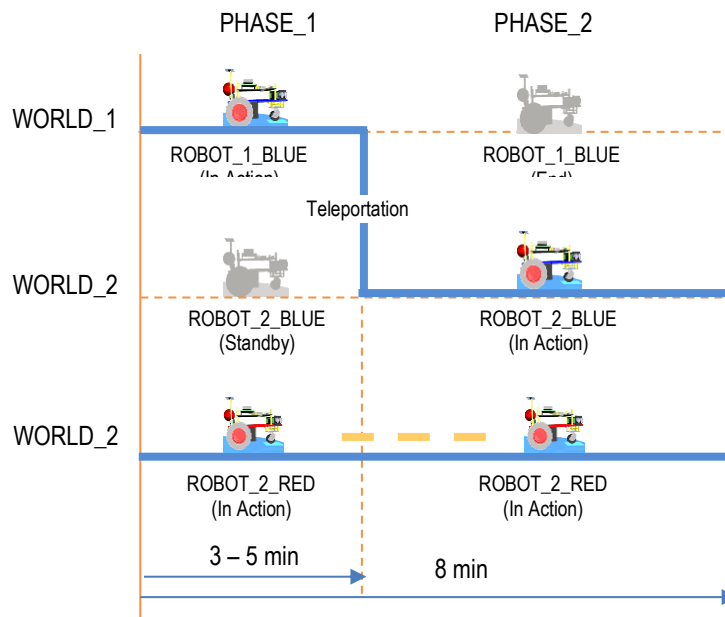
Figure 11: SuperTeam Game Process

12.2 Phase_1

12.2.1 The ROBOT_1_BLUE works on a rescue mission in WORLD_1 while competing with another team's robot. The ROBOT_1_BLUE will only stay in WORLD_1 for 3 – 5 minutes.

12.2.2 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.

12.3 Teleportation:

12.3.1 A team needs to teleport their ROBOT_1_BLUE at any time after 3 minutes but before the first 5 minutes passed whilst ending the ROBOT_1_BLUE's movement, for the teleportation to be considered successful. Team will gain 100 bonus points for the successful teleportation.

12.3.2 Teleportation within the first 3 minutes is invalid.

12.3.3 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.

12.4 Phase 2:

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

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

13. Game Play

Please refer to section 8 for the game play procedure.

13.1 Scoring

13.1.1 Scores allocated to objects in the WORLD_1 and WORLD_2 are as follows.

Object Type	Points in WORLD_1		Points in WORLD_2	
	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

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

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

13.2 Lack of Progress

13.2.1 Each SuperTeam can call relocation up to 3 times. The referee will keep track of the number of relocations requested.

13.2.2 Teams are not allowed to stop a round early.

13.3 Winner of SuperTeam Competition

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

Part D: Appendix

APPENDIX A: Robot Configuration
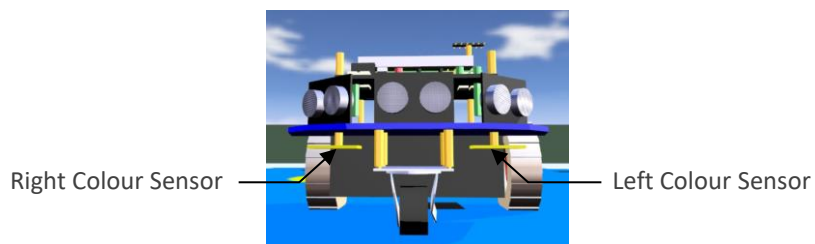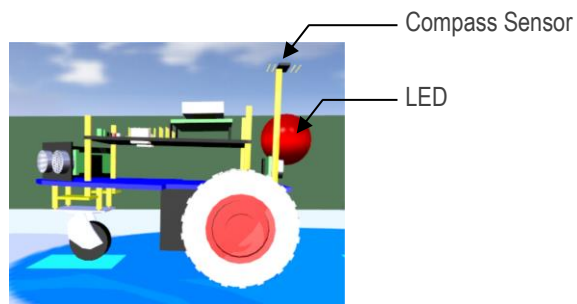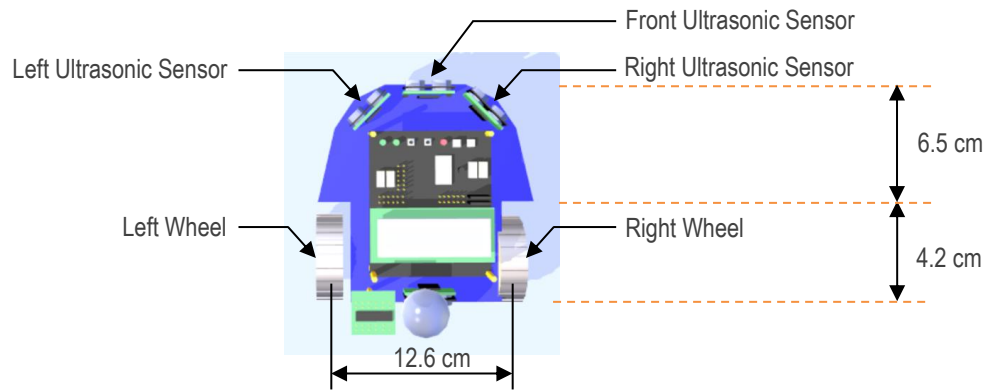
APPENDIX B: Competition Setup

- The coordinates of robots, special zones, collection boxes, traps, signal block zones will be provided to the teams.
- The coordinates of SUPER and SUPER+ objects will be sent to the team that generates the objects.

SuperTeam Challenge

- The coordinates of robots, special zones, collection boxes, traps, signal block zones will be provided to the teams.
- The coordinates of SUPER and SUPER+ objects will be sent to the team that generates the objects.

APPENDIX C: Map used in the World Championship

Full Map

The FULL Map will only be installed on the game station. It will not be copied to participants' stations throughout the whole challenge.
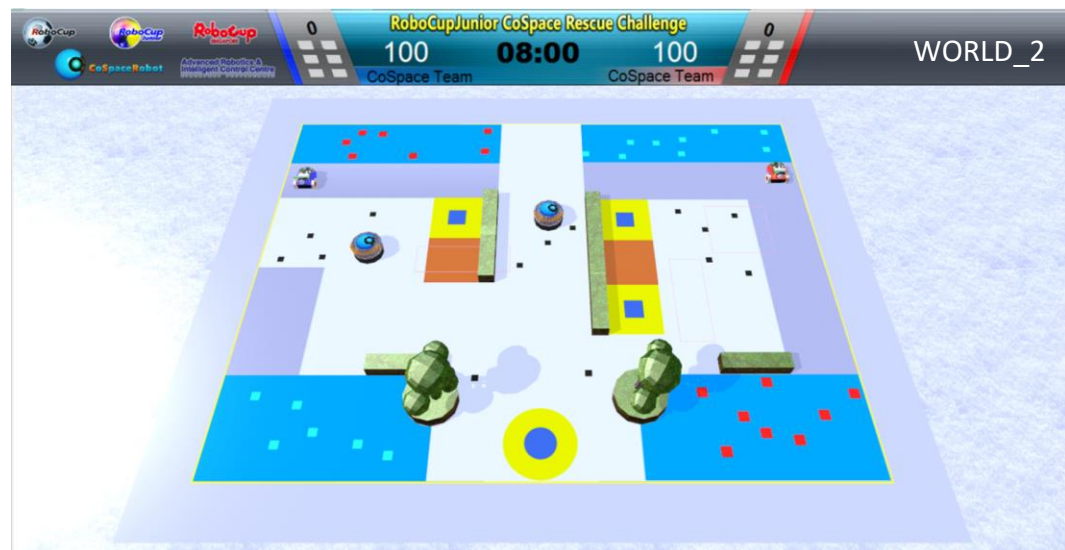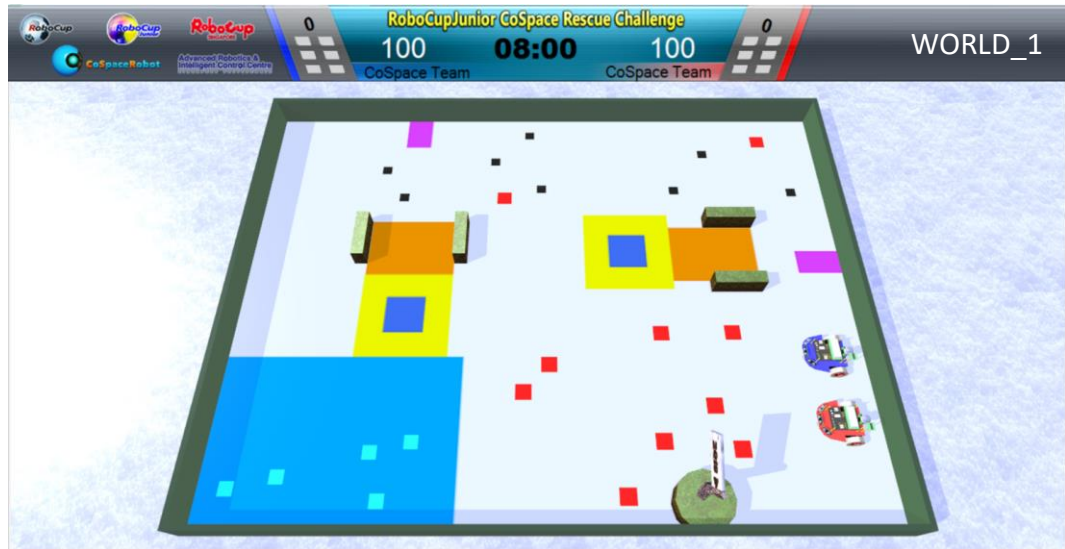
Partial Map

The PARTIAL Map will be released to teams. This map is incomplete. Teams need to combine the information given in the layout of WORLD_2 and the element map of WORLD_2 to work out the best AI strategy to accomplish the mission.
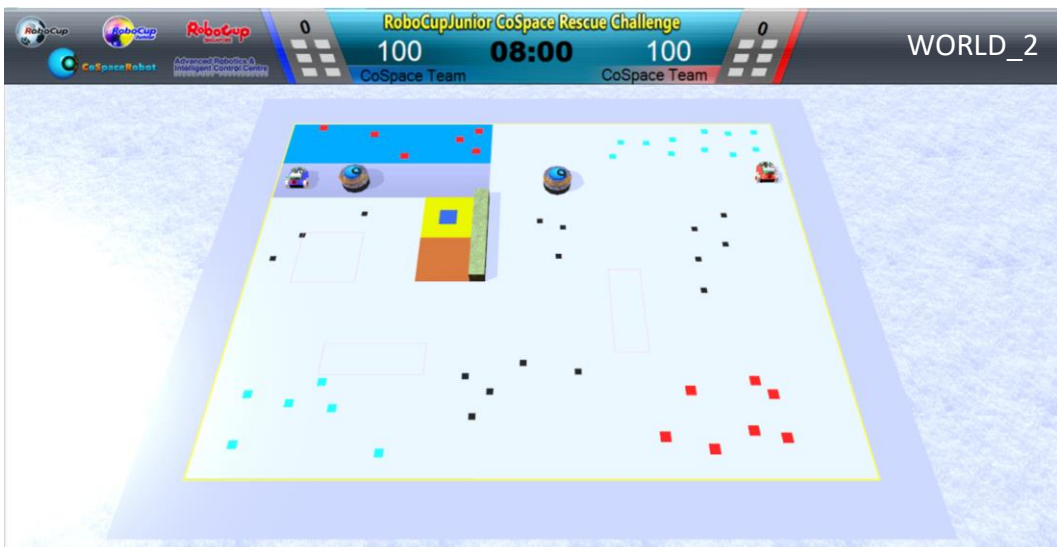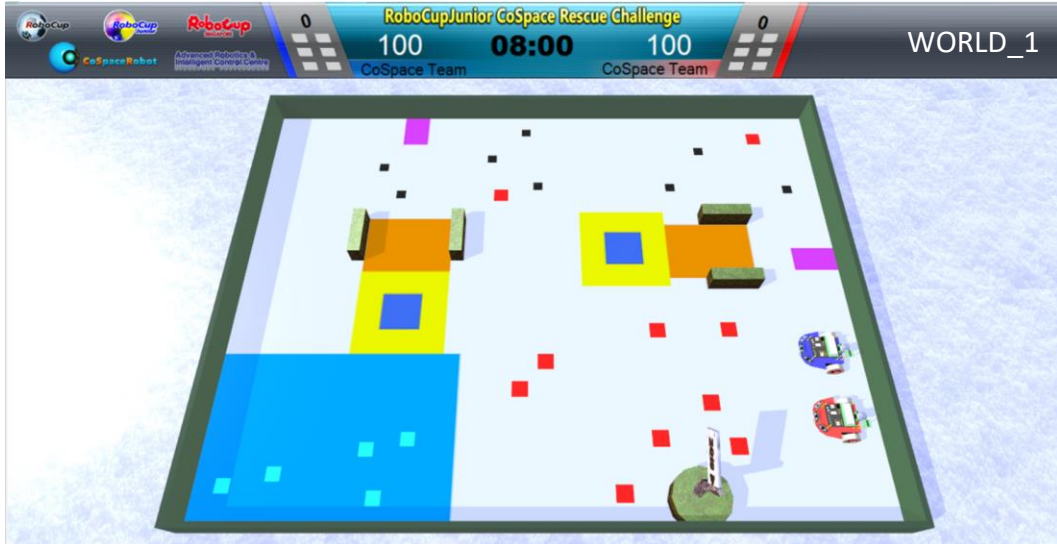
Layout of WORLD_2

The layout below shows the objects distribution and teleportation locations. The other elements, such as special zones, swamplands, etc. are extracted from the PARTIAL Map of the WORLD_2.
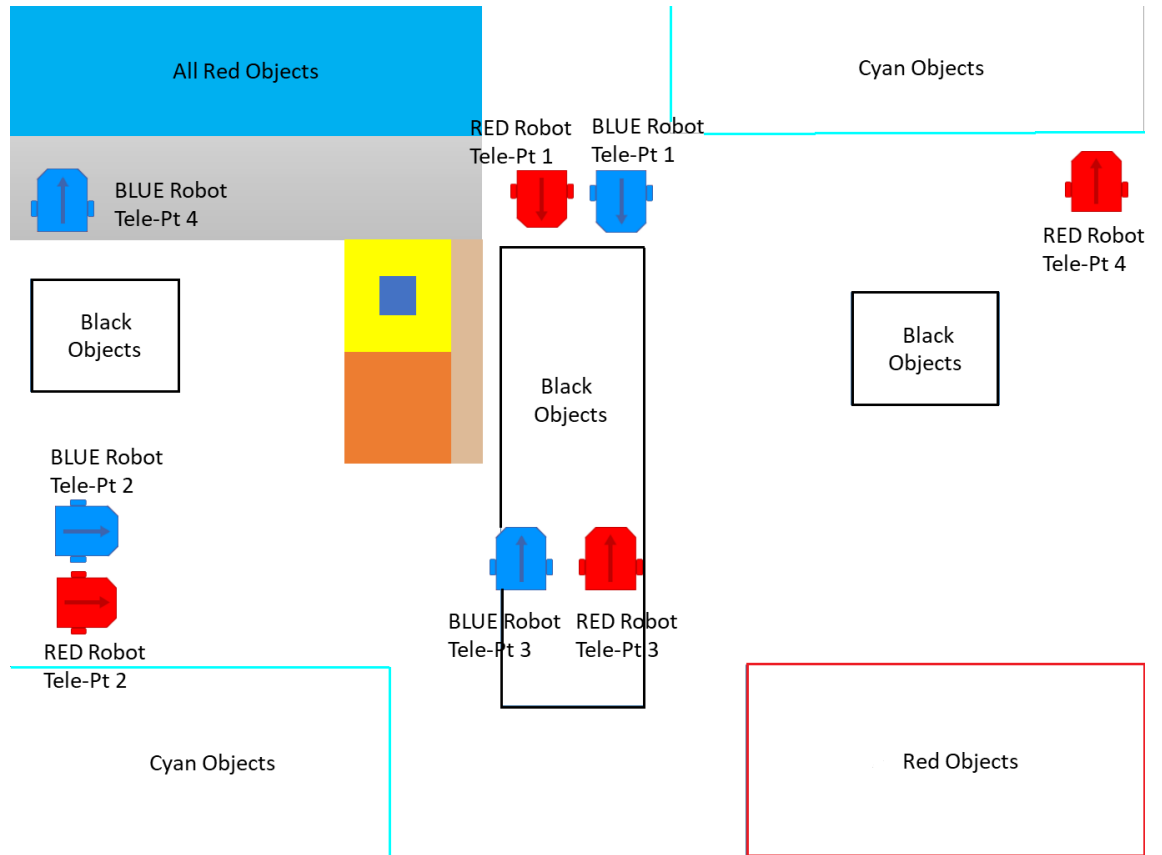
Element Table of WORLD_2

The WORLD_2 is divided into 8 x 6 small segments. The table below shows the elements appearing on each segment. These elements are extracted from the FULL Map of the WORLD_2.

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
Special Zone Swampland	Special Zone Swampland	Special Zone Swampland	Regular Zone Special Zone Swampland	Regular Zone Special Zone Swampland	Special Zone Swampland	Special Zone Swampland	Special Zone Swampland
Regular Zone Swampland	Regular Zone Swampland	Regular Zone Swampland Trap	Regular Zone Swampland Obstacle	Regular Zone Swampland	Regular Zone Swampland Trap Obstacle	Regular Zone Swampland	Regular Zone Swampland
Regular Zone Swampland	Regular Zone	Regular Zone Trap Collection Box Obstacle	Regular Zone Collection Box	Regular Zone Collection Box	Regular Zone Trap Collection Box Obstacle	Regular Zone	Regular Zone Swampland
Regular Zone Swampland	Regular Zone	Regular Zone Collection Box	Regular Zone Collection Box Obstacle	Regular Zone Collection Box	Regular Zone Trap Collection Box Obstacle	Regular Zone	Regular Zone Swampland
Regular Zone Special Zone Swampland	Regular Zone Special Zone Obstacle	Regular Zone Special Zone Obstacle	Regular Zone	Regular Zone Obstacle	Regular Zone Special Zone Obstacle	Regular Zone Special Zone Obstacle	Regular Zone Special Zone Swampland Obstacle
Special Zone	Special Zone	Regular Zone Special Zone Obstacle	Regular Zone Trap	Regular Zone Trap Obstacle	Regular Zone Special Zone Obstacle	Special Zone	Special Zone

APPENDIX D: Team Description Paper (TDP) Template

Cover page:

RoboCupJunior 2021 Rescue Simulation
Team Description Paper

Team Name: _____

Participants Name: Student 1, email

                      Student 2, email

                      Student 3, email

                      ….

Mentor Name: Mentor name, email

Institution: _____

Region/Country: _____

Contact Person: _____

Date: _____

RoboCupJunior 2021

Team Description Paper

Rescue Simulation (former CoSpace)

Student 1, Student 2
Team Name, Region/Country
Website

1. Abstract

2. Introduction

      a. Team Background

      b. Team website (if you have one)

      c. Team photo (optional)

      d. Provide a video of your Rescue Simulation (former CoSpace) (URL)

      e. Previous RoboCup experience

3. Strategy

      a. Description of your strategy for Rescue Simulation (former CoSpace) search and rescue

      b. Include flowcharts or pseudocode if appropriate

      c. Describe and highlight innovative search and rescue algorithms in any

4. Discussion and Conclusion

      a. Share your team's Rescue Simulation (former CoSpace) learning experience

      b. Highlight collaboration with other teams if any

      c. Description of future work

5. Acknowledgements

6. References