RCAP CoSpace Rescue Rules 2020

(CoSpace Rescue, Category U19)

These are the official rules for the RoboCup Asia Pacific (RCAP) 2020 CoSpace Rescue Challenge. They are released by the RoboCup Asia Pacific CoSpace Rescue Technical Committee. The English rules have priority over any translations. Changes from the 2019 rules are highlighted in red.

PREFACE

In RCAP CoSpace Rescue Challenge, 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.

In the RCAP CoSpace Rescue Challenge, students need to make their own robot, code the robot, and finally take part in the CoSpace Rescue Challenge.

The RCAP CoSpace Rescue Simulator is the only official platform for the sub-league. This simulator allows programs to be developed using a graphical programming interface or C language. Participation teams can contact support@cospacerobot.org for RCAP CoSpace Rescue Simulator download, help and assistance.

Category U19, World 1

Category U19, World 2

Figure 1: CoSpace Rescue Challenge

OVERVIEW

Judging Criteria

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 learning journal, solution to a specific task, and Team Description Paper (U19 group). 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 CoSpace Challenge.

  Teams may be asked to have 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 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. Technical Challenge task will be announced on site. Its format may be completely different from the traditional CoSpace Rescue 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 (refer to section 10.4).

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 RoboCup Asia Pacific Competition, 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' strength and work together to create a new AI to solve a new task. SuperTeams are encouraged to express their friendship and cooperation and to demonstrate what they have learnt from each other.

The SuperTeam Challenge is a special program for the RCAP Finals and is not obligatory for regional events.

Contents

1 Team

1.1. Team Members

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

1.1.2 All team members must be at the right age for the respective age group.

- U19 group: Teams with all student members aged 13 to 19 year old can participate in this category. If a team has mixed ages (with both U12 and U19 members), they will be allowed to compete in U19 category.

Age is specified as on 1st July in the year of the competition.

1.1.3 Every team member need to carry out a technical role for the team (strategy planning, programming, etc.), which should be identified at the registration. Each member will need to explain his/her technical role and should be prepared to answer questions on the technical aspects of their involvement in preparing the CoSpace Rescue Challenge.

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

1.2. Team Captain

1.2.1 Each team must have a captain. The captain is the person responsible for communication with referees during the game.

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

2 CoSpace Rescue Description

2.1 Game process

2.1.1 For RCAP CoSpace Rescue U19 groups. A game lasts 6 minutes, with two teams competing in one game. A game consists of a real world (REAL_WORLD) and a virtual world (VIRTUAL_WORLD). A team has one robot in each WORLD as shown in figure 2.

(a) The real robot (REAL_ROBOT) can spend between 3 minutes in REAL_WORLD.

(b) The virtual robot (VIRTUAL_ROBOT) will spend another 3 minutes in VIRTUAL_WORLD.

2.1.2 For RCAP CoSpace Rescue U19 groups. A team must program REAL_ROBOT and VIRTUAL_ROBOT to navigate and collect objects in REAL_WORLD and VIRTUAL_WORLD. Only one robot can move at any one time.

- When REAL_ROBOT moves in REAL_WORLD, VIRTUAL_ROBOT must be in standby mode.
- A team must end REAL_ROBOT and activate the VIRTUAL_ROBOT when transferring from REAL_WORLD to VIRTUAL_WORLD.

- When the VIRTUAL_ROBOT is activated, REAL_ROBOT stops until the end of the game.

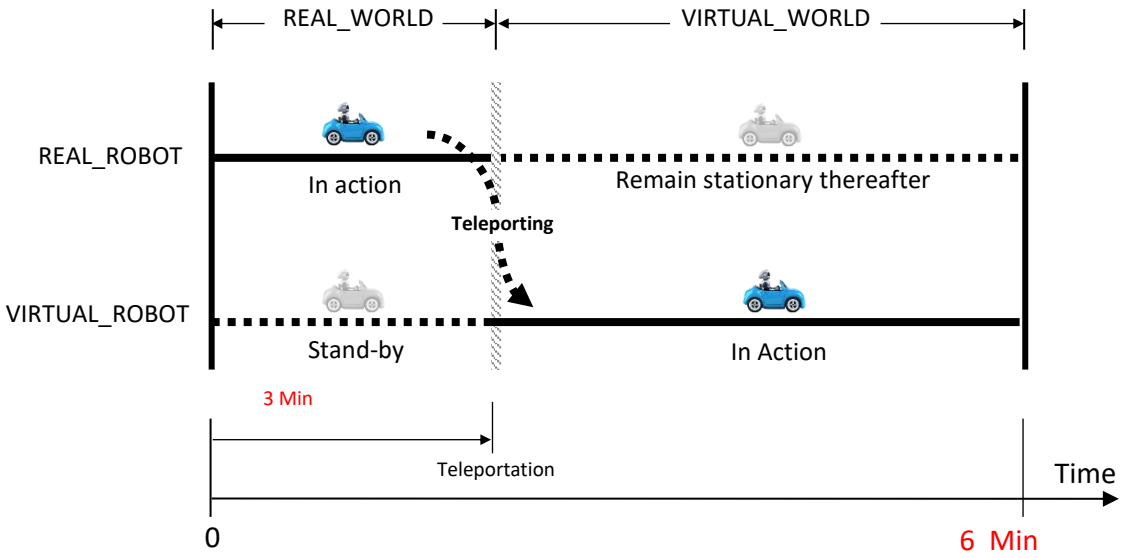


Figure 2: CoSpace Rescue process

2.1.3 For RCAP CoSpace Rescue FirstSteps group. A game lasts 5 minutes, with two teams competing in one game. A game consists of a virtual world ONLY (VIRTUAL_WORLD). A team has ONLY one robot in VIRTUAL_WORLD.

2.2 REAL_WORLD

2.2.1 A game begins with REAL_ROBOT navigating in REAL_WORLD.

2.2.2 In the real world, REAL_ROBOT searches for 3 types of objects, RED, CYAN, and BLACK objects. REAL_ROBOT 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.

2.2.3 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 7.4.4).

2.3 Teleportation

Teleportation means ending REAL_ROBOT's movement in REAL_WORLD and activating the team's VIRTUAL_ROBOT in VIRTUAL_WORLD.

2.3.1 A team needs to set teleport point within 3 minutes (0-179 seconds) by program REAL_ROBOT.

2.3.2 If a team fails to set teleport location by the end of the first 3 minutes, VIRTUAL_ROBOT will be activated by the CoSpace server automatically (refer to section 7.4.5).

2.4 VIRTUAL_WORLD

2.4.1 In VIRTUAL_WORLD, VIRTUAL_ROBOT searches for 5 types of objects, RED, CYAN, BLACK, SUPER and SUPER+ objects. VIRTUAL_ROBOT 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.

2.4.2 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 in World 2(refer to section 5.2.1).

2.5 Competition Setup

2.5.1 A Team must be able to program both REAL_ and VIRTUAL_ROBOT and establish communication between them in order to teleport from REAL_WORLD to VIRTUAL_WORLD.

2.5.2 Virtual/real robots must be controlled autonomously.

2.5.3 The use of a remote control to manually control virtual/real robots is not allowed.

3 Arena

3.1 Dimensions

3.1.1 The dimensions of REAL_WORLD are 180cm x 240cm. The dimensions of VIRTUAL_WORLD are 270cm x 360cm.

3.2 Floor

3.2.1 REAL_WORLD

- The floor of REAL_WORLD is generally white. The floor may be either smooth or textured.
- The REAL_WORLD will be placed so that the floor is level.

3.2.2 VIRTUAL_WORLD

- The VIRTUAL_WORLD is a 3D simulated environment. The floor is not restricted to white or light colour. However, the colour objects, collection box, special zones, etc., can still be distinguished.

3.3 Boundary

3.3.1 REAL_WORLD

REAL_WORLD will be enclosed by a wall of height 20 cm.

3.3.2 VIRTUAL_WORLD

- U19 group: There will be no boundary for VIRTUAL_WORLD. 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.

Appendix A shows the sample layout of REAL_WORLD and VIRTUAL_WORLD. Appendix B shows the real field building instruction.

4 REAL_WORLD and VIRTUAL_WORLD Layout

Both REAL_ WORLD and VIRTUAL_WORLD contains various elements as follows:

4.1 Markers

4.1.1 There may be some markers in the virtual/real worlds. The makers can be used to help the virtual/real robot 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.

4.2 Special zones

4.2.1 Certain areas in the virtual/real 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 3. The special zones have a minimum size of 30cm x 30cm. The shape of the special zone is not fixed.

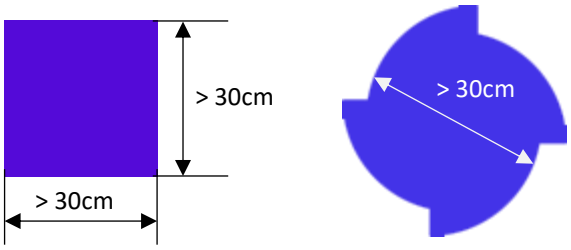


Figure 3: Sample of Special Zones

4.3 Obstacles

4.3.1 Obstacles found in real and virtual worlds can be of any size, any shape with the minimum dimensions of 10cm x10cm.

4.4 Traps

4.4.1 Traps are surrounded by a yellow boundary as shown in figure 4. 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.

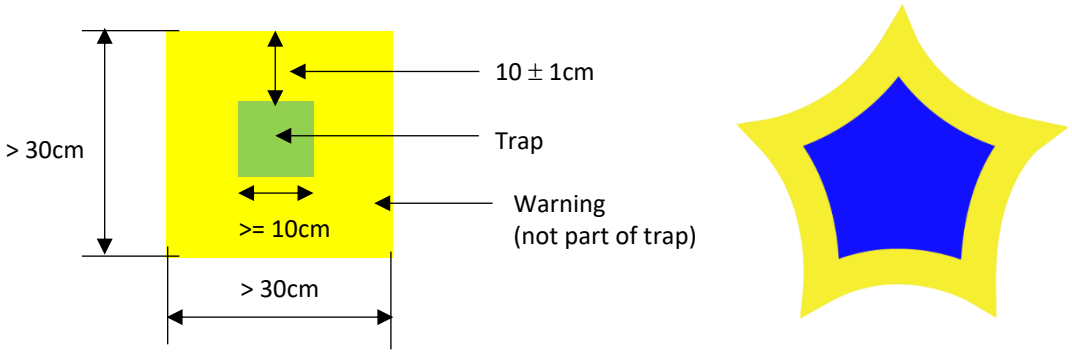


Figure 4: Sample of Traps

4.5 Object Collection Boxes

4.5.1 Figure 5 shows the object collection box. The collection box is ORANGE in colour. The dimensions can be (30 ± 3) cm x (30 ± 3) cm. The collection box can be any shape.

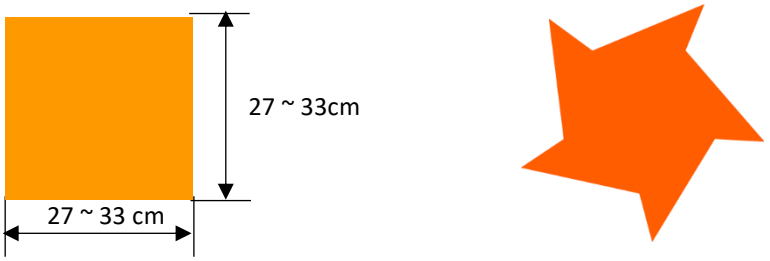


Figure 5: Sample of object collection boxes

4.6 Robot Coordinates (U19 Group – VIRTUAL_WORLD Only)

4.6.1 For the U19 group, the CoSpace Server will send the robot its own coordinates while the robot is searching in the VIRTUAL_WORLD. Figure 6 shows the virtual robot is at position (180cm, 197cm).

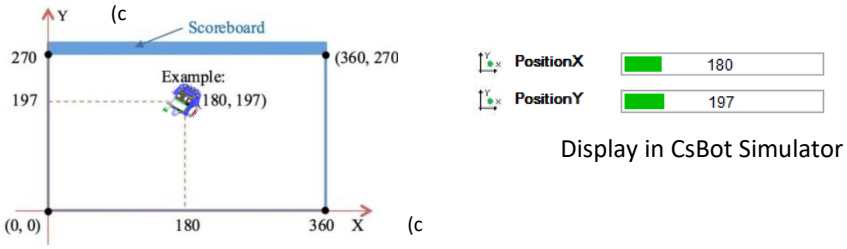


Figure 6: X & Y coordinate system for robot in VIRTUAL_WORLD

4.7 Swamplands (U19 Group – VIRTUAL_WORLD Only)

4.7.1 Certain areas in the VIRTUAL_WORLD are designated as swamplands. The swampland is grey color as shown in figure 7. The swampland can be any size bigger than 30cm x 30cm. The shape of the swamplands is not fixed

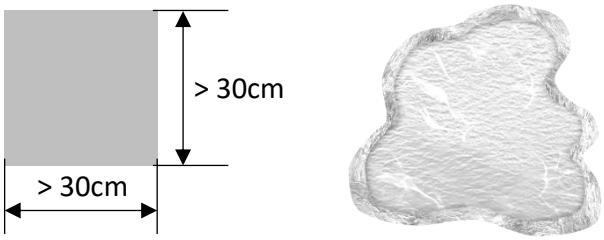


Figure 7: Sample of Swamplands

4.8 Signal Block Zone (U19 Group – VIRTUAL_WORLD Only)

4.8.1 In the VIRTUAL_WORLD for U19 group, there are 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.

4.8.2 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.

4.8.3 There are 3 Signal Block Zones in the VIRTUAL_WORLD.

5 Objects

5.1 Basic Objects

5.1.1 There are THREE types of objects, RED, CYAN, and BLACK located randomly throughout the course. The thickness of each object is less than 2mm. Each type of objects worth different value (refer to section 7.4.2).

5.1.2 Colour, size and shape of the objects

Colour, size and shape of the objects will be different for FirstSteps, U12 and U19 groups. Appendix C shows the details.

5.2 SUPER and SUPER+ Objects (U19 Groups – VIRTUAL_WORLD Only)

5.2.1 Creation of SUPER and SUPER+ objects

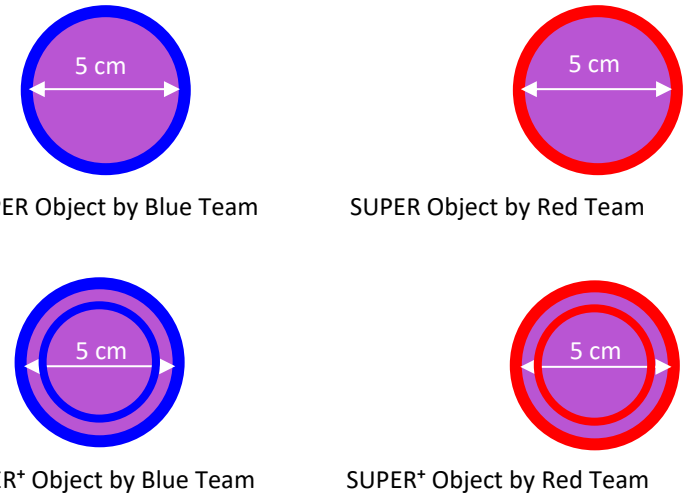
(a) ONE SUPER Object will be generated for every ONE set of RED, CYAN and BLACK objects collected and deposited successfully (refer to section 7.4.3) in the VIRTUAL_WORLD.

(b) ONE SUPER+ Object will be generated for every TWO sets of RED, CYAN and BLACK objects collected and deposited successfully (refer to section 7.4.3) in the VIRTUAL_WORLD.

(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 itself.

5.2.2 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.



SUPER Object by Blue Team

SUPER Object by Red Team

SUPER+ Object by Blue Team

SUPER+ Object by Red Team

Figure 8: SUPER and SUPER+ objects

5.2.3 Placement of SUPER and SUPER+ objects (U19 Groups)

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 CoSpace Rescue Simulator user guide.

6 Robot

6.1 REAL_ROBOT Configuration

6.1.1. The RCAP CoSpace Rescue Challenge uses a Standard Platform. The basic design of the REAL_ROBOT consists of a battery holder, a chassis, motors, electronics， controllers and sensors. The REAL_ROBOT has the following configuration:

- 3 ultrasonic sensors
- 1 gyro sensor
- 2 RGB sensors
- 2 DC motors
- 1 LED for status indication
- 1 XBee

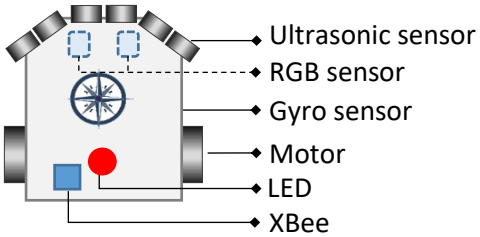


Figure 9: REAL_ROBOT configuration

6.1.2 Teams are not allowed to change motors, controllers, and sensors in this challenge. Teams should paste the robot CID on the robot chassis (it can be found using CoSpace Rescue Simulator). It is encouraged to make to carry a small flag with a team name and team ID.

6.2 VIRTUAL_ROBOT Configuration

6.2.1 The Configuration of VIRTUAL_ROBOT is the same as REAL_ROBOT.

6.3 ROBOT Control

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

6.3.2 REAL_ROBOT must be started manually by the team captain.

6.3.3 Any pre-mapped type of dead reckoning strategy (movements predefined based on known locations or placement of features in the field) is prohibited.

6.3.4 REAL_ROBOT must not damage any part of the field in any way.

6.4 Real/Virtual Communication

6.4.1 ZigBee communication protocol is used in the Rescue CoSpace robot platform for establishing the real/virtual robot communication. Teams need to setup the communication between REAL_ROBOT and CoSpace server via XBee so that the team can teleport their robots from REAL_WORLD to VIRTUAL_WORLD.

6.4.3 Teleportation within the first 3 minutes is invalid.

6.4.4 If a team fails to teleport within the first 5 minutes, the CoSpace server will stop REAL_ROBOT and activate VIRTUAL_ROBOT automatically (refer to section 7.4.5).

6.5 Lighting

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

6.5.2 For teams using real robot, 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.

6.5.3 Every effort will be made by the organizers to locate the real world away from sources of magnetic fields such as under-floor wiring and metallic objects, however, sometimes this cannot be avoided.

7 Gameplay

7.1 Pre-setup

7.1.1 The layout of both REAL_WORLD and VIRTUAL_WORLD will be released to teams prior to the tournament.

7.2 Pre-round Practice

7.2.1 Wherever necessary, teams will have an access to a practice field for calibration. Teams can calibrate their sensors ONLY before a game at the real field. Calibration is defined as the taking of sensor readings and modifying of the real robot's program to accommodate such sensor readings. Calibration can be done in as many locations as desired.

7.3 Game Procedure

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

7.3.2 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.

7.3.3 5 minutes before each game

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

(b) Teams are allowed to change the AI before each game (ONLY ONCE) and submit the revised version to the referee. The referee will continue to use AI_1 if there is no revised AI submission.

7.3.4 3 minutes after the scheduled game time

(a) 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.

7.3.5 Pre-match Meeting

(a) 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.

7.3.6 Start of Play

(a) Real game

- Teams should program and download the code to the real robot before the real game. It is team's responsibility to ensure that the correct program is downloaded to the correct robot.

(b) Virtual game

- 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.
- It is the team captain's responsibility to ensure that the correct program is uploaded.
- Team captains must be present during the full length of the game.

7.4 Scoring

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

7.4.2 Collecting objects

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 color sensor has detected the object.

Object Type	Points in Real World	Points in Virtual World

	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	NA	90	90
SUPER+	NA	NA	180	180

(a) A real/virtual robot cannot collect more than 6 objects at any one time without unloading or depository them in the collection box.

(b) Objects in the real world will NOT disappear after they are collected. It is 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.

(c) Objects in the virtual world will disappear after they are collected.

7.4.3 Depositing objects

When a robot deposits objects successfully, the points of the objects deposited will be doubled.

"Robot deposits objects successful" means:

- A 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 the colour sensor detects the collection box (the colour sensor is in the collection box).

- The robot will exit the collection box autonomously after deposition (the colour sensor is out of the collection box).

7.4.4 Bonus points (only for REAL_WORLD)

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

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

7.4.5 Communication and Teleportation

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

(b) For unsuccessful teleportation, the robot will be placed in VIRTUAL_WORLD by the CoSpace server. No bonus will be given. Teams cannot choose the location in VIRTUAL_WORLD that the robot will be teleported to.

7.4.6 Falling into a Trap

If a virtual/real robot falls into a trap (refer to section 4.4), all objects that have been collected but not yet placed in the object collection box (refer to section 4.5) 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 color sensor has detected the trap.

7.4.7 Falling into a Swampland (U19 Group – VIRTUAL_WORLD Only)

If a robot falls into a swampland (refer to section 4.7), the robot's speed will be reduced by 80% by the CoSpace server.

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

7.4.8 Falling into a Signal Block Zone (U19 Group – VIRTUAL_WORLD Only)

If a robot falls into a signal block zone, no points will be deducted. However, the robot's position info (refer to 4.8) will be lost.

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.

7.4.9 Out of Boundary (U19 Group – VIRTUAL_WORLD Only)

If a robot is out of the boundary, it will be placed inside VIRTUAL_WORLD by the CoSpace server automatically. No points will be deducted. However, it will be frozen for 10 seconds.

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

7.4.10 Game Points

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

Game	GAME POINTS
Win	3
Tie	1
Loss	0

7.5 Human Interference

7.5.1 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 at the discretion of the referee, officials, organizing committee or general chairs.

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

7.6 Relocation

7.6.1 In real game, the team captain can request for relocation for the following case:

(a) REAL_ROBOT is stuck

(b) REAL_ROBOT is looping

(c) REAL_ROBOT is not performing well.

Upon team's request, the referee will call "RELOCATE" and relocate REAL_ROBOT to a different location but close to where it was with different orientation. The REAL_ROBOT will NOT be frozen after relocation. Each team can call relocation up to 3 times in the REAL_WORLD in each game.

7.6.2 In virtual game, the team captain can request to relocate the VIRTUAL_ROBOT to a different location for the following case:

(a) VIRTUAL_ROBOT is looping

(b) VIRTUAL_ROBOT is not performing well.

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

7.6.3 In virtual game, 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 automatically. After relocation, the VIRTUAL_ROBOT will not be frozen for another 10 seconds. The relocation by CoSpace server will not be recorded as in section 7.6.2.

7.6.4 A team may decide to stop a round early if the lack of progress cannot be resolved within the first 5 minutes. 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.

7.7 Penalty

7.7.1 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.

7.7.2 If a virtual/real robot is hit/attacked by another virtual/real 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.

7.7.3 If two virtual/real 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.

7.8 Interruption of Game

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

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

7.8.3 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.

7.8.4 Teams are not allowed to quit a game 5 minutes after the game started.

8 Conflict Resolution

8.1 Referee

8.1.1 During a gameplay, the referee's decisions are final.

8.1.2 At conclusion of game play, the referee will ask the captain to sign the score sheet. 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 in the score sheet and sign it.

8.2 Rule Clarification

8.2.1 It is team's responsibility to verify at the RoboCup Asia Pacific Official website on the latest version of the rules prior to the competition. If any rule clarification is needed, please contact the RCAP CoSpace Rescue Technical Committee.

8.2.2 If necessary even during a tournament, a rule clarification may be made by members of the RCAP CoSpace Rescue Technical Committee and Organizing Committee.

8.3 Special Circumstances

8.3.1 In special circumstances, such as the occurrence of unforeseen problems or malfunction of a robot, rules may be modified by the RCAP CoSpace Rescue Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, even during a tournament if necessary.

8.3.2 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 8.3.1, it will be considered as an endorsement.

9 Documentation

9.1 Learning Journal (U12 Group Only)

9.1.1 The learning journal submission is required for U12 group only.

9.1.2 Each team must bring a learning journal or any form of documentation describing the information about the team, their preparation efforts in programming and how they prepared for RCAP. The learning journal must be presented during the interview, and may be called upon to help establish the authenticity of a team's performance.

9.2 Team Description Paper (U19 Group Only)

9.2.1 The Team Description Paper (TDP) submission is expected for teams to participate in the RCAP finals.

Each team is required to submit a TDP (2 - 4 pages) two weeks before the official starting date of the RCAP finals. The TDP should include the team description, strategy, discussion and conclusion. Refer to Appendix D for TDP format. Teams need to send the TDP to the Rescue CoSpace Technical Committee for review. Teams are required to present the TDP during the interview. Teams may be called upon to help establish the authenticity of a team's performance.

9.3 Poster (Both U12 and U19 Groups)

9.3.1 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.

9.3.2 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 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.

10 Judging and Award

10.1 Technical Interview (RACP Finals)

10.1.1 It is compulsory for all teams to attend the technical interview. Teams may take the "interview key points" for reference while preparing their interview. Refer to Appendix E.

10.1.2 During the interview, students will be asked about their preparation efforts.

For U12 group: Teams are required to bring the leaning journal and give a 5-minute technical presentation. A 5-10 minutes Q&A will also be carried out.

For U19 group: Teams are required to give a 5-minute technical presentation based on the TDP, this should be entirely technical based presentation. A 5-10 minutes Q&A will also be carried out.

10.1.3 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 for the arrangement of translators.

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

10.1.5 Team members have to indicate whether he/she will take part in the Technical Challenge (refer to section 8.2) and Best Strategy Challenge (refer to section 8.3).

10.2 Technical Challenge (to be applied to RCAP Finals only)

10.2.1 The Technical Challenge is to evaluate individual team's capability in AI planning and coding capability. The Technical Challenge task will be announced on site. Its format may be completely different from the traditional CoSpace Rescue mission. Teams are required to submit the solution within 2 hours.

10.2.2 It is compulsory for teams to take part in the Technical Challenge. During the programming period, students are not allowed to leave the team area.

10.2.3 U12 group: All team members are required to work as a team to take part in the Technical Challenge. Discussion can be carried out among team members, but they are not allowed to consult mentors or other members who are not participating in the technical challenge.

10.2.4 U19 group: 50% or more of team members are required to attend the Technical Challenge. i.e. minimum 2 members are required for a team of 4. Minimum 3 members are required for a team of 5. 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.

10.2.5 The Technical Challenge result will be used as the evaluation criteria for the "winner of the round robin" (refer to section 10.5.1) and the "Best Strategy Award" (refer to section 10.5.3).

10.3 Best Strategy Challenge (to be applied to RCAP Finals only)

10.3.1 The Best Strategy Challenge is not compulsory for every member. Only students aiming for the Best Strategy Award are required to take part in the Challenge.

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

10.3.3 The task will be announced on site. Candidates will have two and half-hours to complete the task. During the programming period, candidates are not allowed to leave the team area.

10.4 Friendship Tournament

10.4.1 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.

10.4.2 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 RCAP CoSpace Rescue Organizing Committee onsite. The last survivor will be the winner.

10.5 Winner

10.5.1 Round Robin

- The ranking of the Robbin 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:

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

- 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 VIRTUAL_WORLD will be the winner.

10.5.2 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 match tie, the team with the higher points in VIRTUAL_WORLD will be the winner.
- If the points in VIRTUAL_WORLD tie, the teams will move to go re-match.

10.5.3 Best Strategy

- U12 group: The winner will solely depend on the Best Strategy Challenge Result
- U19 group: The winner will be determined based on the combination of 30% of Technical Challenge Result (individual score) and 70% of the Best Strategy Challenge result.

10.5.4 Best Novice Team

- The winning team must consist of all new members from a new team and a new school.
- The team must be one of the top 4 teams in its age group.

10.5.5 Friendship Tournament

- The winner will be the last survivor of the Friendship Tournament.

10.6 Awards

Depending on the number of teams entering the competition, there will be awards for trophies and certificates. The Organizing Committee can adjust the award type (trophy or certificate) if needed. Trophies and certificates will be awarded for FirstSteps, U12 and U19 group. These awards list will be released closer to the event.

11 Code of Conduct

11.1 Fair Play

11.1.1 Humans that cause a deliberate interference with real robots or damage to the real field setup will be disqualified.

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

11.2 Behaviour

11.2.1 If one team copies a program from another team, both teams will be disqualified.

11.2.2 Teams will be disqualified for deliberately trying to lose the game or tie with the opponent team.

11.2.3 Team members should be mindful of other people and their robots when moving around the tournament venue.

11.2.4 Team members are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by referee.

11.2.5 Team members who misbehave may be asked to leave the building and risk being disqualified from the tournament.

11.2.6 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

11.2.7 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 or referee decisions will result in a warning in the first instance. If it reoccurs, the team will risk being disqualified.

11.3 Sharing

11.3.1 Teams are encouraged to share their programming and strategies to the members from other teams.

11.3.2 Any developments may be published on the RCAP website after the event.

11.3.3 This furthers the mission of RoboCupJunior as an educational initiative.

11.4 Spirit

11.4.1 It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.

11.4.2 The referees and officials will act within the spirit of the event.

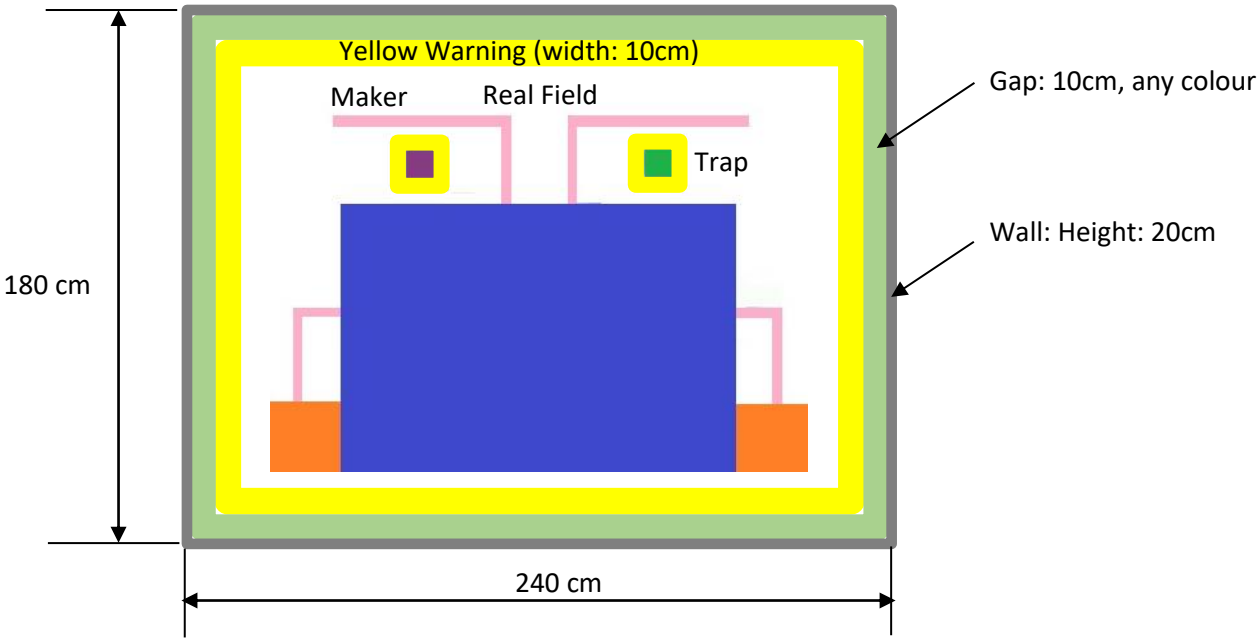
11.4.3 It is not whether you win or lose, but how much you learn that counts!

Rule clarification: RCAP_Challenge@CoSpaceRobot.org

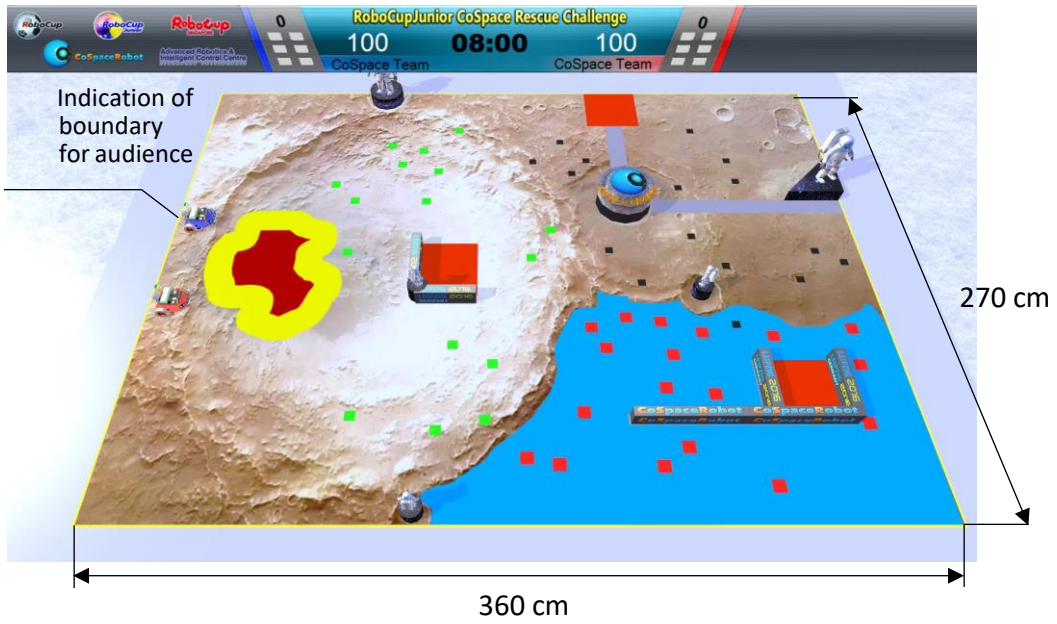
Technical support: support@CoSpaceRobot.org

12 APPENDIX A: Competition Setup

12.1 REAL_WORLD



12.2 VIRTUAL_WORLD (U19 Group)



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

13 APPENDIX B: Real Arena Suggested Building Instructions

The inner dimensions of the real arena are 180cm x 240cm which is about the same as the RCJ soccer field. The following is the suggested instruction for building the real arena. These instructions are applicable only for the World Championship organizers.

(a) Cut a piece of 243 cm x 183 cm plywood or fiberboard (about 1.5cm thickness is adequate). The surface of the board may be either smooth or textured. You may also join a few small ones together. Please make sure the joint is smooth. It should not affect the real robot movement.

(b) Lay the board on the floor. The floor should be level.

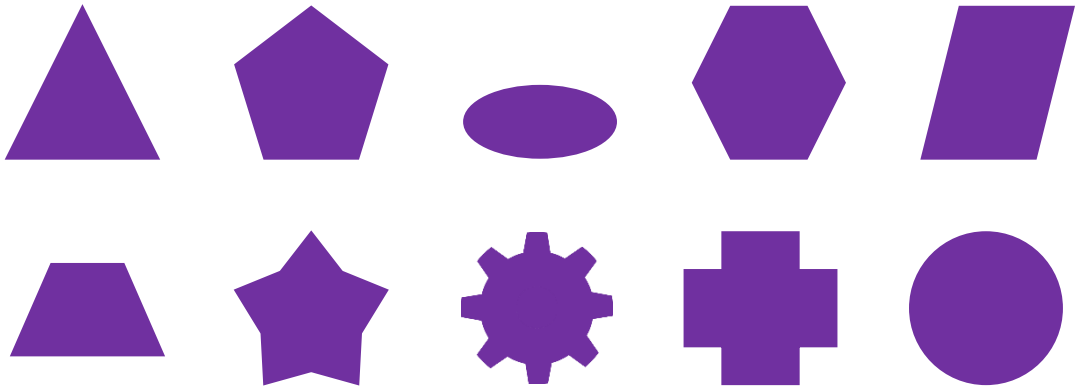
(c) Paint the surface to white colour.

(d) A simple frame should be added at the edge to prevent the robot from falling if the arena is not placed on floor.

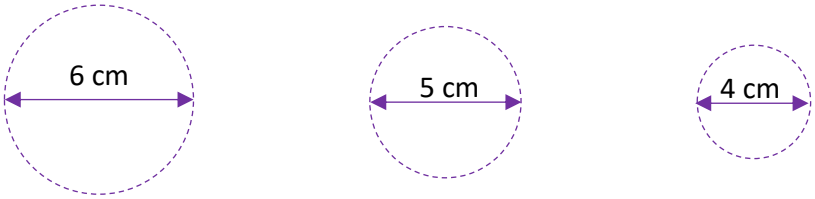
14 APPENDIX C: List of Objects

U19 Group

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



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



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

RED CYAN BLACK

15 APPENDIX D: Team Description Paper (TDP) Template

Cover page:

RCAP 2020 CoSpace Rescue Challenge

Team Description Paper

Team Name: _____

Participants Name: Student 1, email

Student 2, email

Student 3, email

….

Mentor Name: Mentor name, email

Institution: _____

Country: _____

Contact Person: _____

Date: _____

RCAP 2020

Team Description Paper

CoSpace Rescue Challenge (U19)
Student 1, Student 2
Team Name, 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 CoSpace Rescue Challenge (URL)
    e. Previous RoboCup or CoSpace experience
3. Strategy
    a. Description of your strategy for CoSpace rescue search
    b. Include flowcharts or pseudo code if appropriate
    c. Highlight innovative search and rescue algorithms in any
4. Discussion and Conclusion
    a. Share your team's CoSpace learning experience
    b. Highlight collaboration with other teams if any
    c. Description of future work
5. Acknowledgements
6. References

Total Pages: 2 - 4

16 APPENDIX E: Interview Key Points

16.1 U12 Group

1. What was the strategy to solve certain task in your program? Was there any other way to do it? What was the advantage of your method over the others?
2. How would you modify your program if……? (e.g. collection box in a different location, swampland here, lots of black objects in the special zone)
3. Are you able to program a robot to complete a certain task?
4. What have you learnt through the CoSpace Rescue Challenge?
5. The explanation should be clear and logical.

14.2 U19 Group

1. What kind of strategy / methodology / AI algorithm was used to program the search and rescue robot?
2. How did you use the above mentioned method to solve the problem? Please explain in details.
3. What was the major issue you need to consider during the implementation?
4. Can the algorithm be able to adapt to other search and rescue scenarios?
5. What was the most innovative idea in your program?
6. Have you considered other algorithms? If yes, why did you select the current method instead of others? What was your evaluation criteria?