RoboCupJunior CoSpace Rescue Rules 2014

RoboCupJunior CoSpace Technical Committee 2014:

Martin Bader (Germany), martin_bader@gmx.de
Lisette Castro (Mexico), ettesil77@hotmail.com
Josie Hughes (UK), jaeh2@cam.ac.uk
Jiayao Shen (Singapore), jyshen@sp.edu.sg
Baogang Wang (China), ziyunxinxi@126.com

RoboCupJunior CoSpace Technical Consultant:

Tianwu Yang (Singapore), yangtw@sp.edu.sg

This document contains the official rules for RoboCupJunior CoSpace Rescue 2014, and is released by the RoboCupJunior CoSpace Technical Committee. The rules contained in this document have priority over any translations. Differences between the RoboCupJunior CoSpace Rescue 2013 rules and the RoboCupJunior CoSpace Rescue 2014 rules are highlighted in red.

PREFACE

In CoSpace Rescue, 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.

The CoSpace Rescue Simulator can be found at http://www.cospacerobot.org.

GENERAL RULES

1. GAME DESCRIPTION

1.1 Primary Category

1.1.1 Game Process

A game lasts 8 minutes, with two teams competing in one game. A game consists of two parts known as WORLDs. Both WORLD_1 and WORLD_2 are VIRTUAL. A team has one robot in each WORLD as shown in figure 1.

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

A team must program their robots to navigate and collect objects in WORLD_1 and WORLD_2. A team must end the ROBOT_1 and activate the ROBOT_2 (teleportation, see section 1.1.3) when transferring from WORLD_1 to WORLD_2. By successfully teleporting within the 3-5 minute period, the team will be awarded 100 points. If a team fails to teleport within 5 minutes, the robot in WORLD_2 will be automatically activated and the team will not receive 100 points. Teleporting before 3 minutes is invalid.
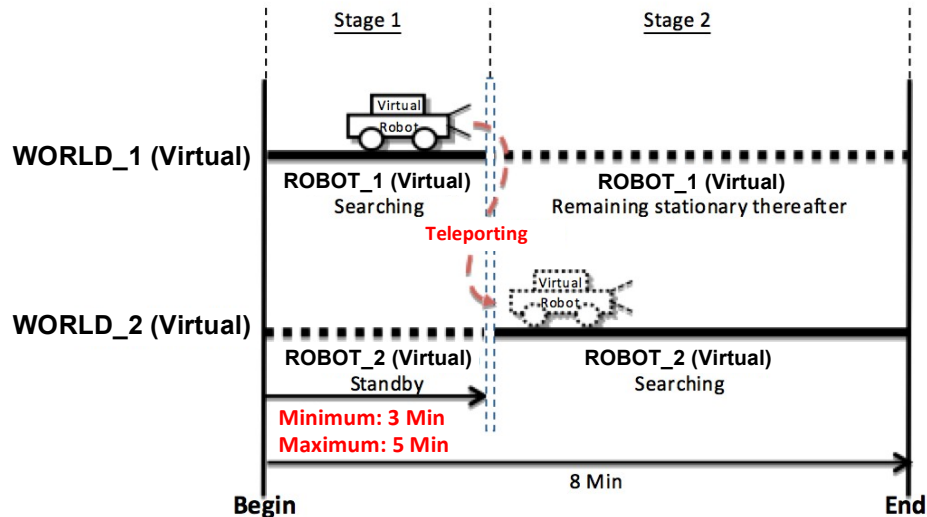
Figure 1: Primary Category Game Process

1.1.2 WORLD_1: Virtual

(a) A game begins with virtual ROBOT_1 navigating in WORLD_1 while virtual ROBOT_2 is 'standing by' in the WORLD_2 (virtual world).

(b) In the WORLD_1, ROBOT_1 searches for 3 types of objects, RED, GREEN, and BLACK objects. ROBOT_1 has to collect and then deposit objects 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.

(c) Any one set of RED, GREEN and BLACK objects that are deposited with one single trip to the collection box will form one SUPER object. These SUPER Objects will be transferred to the virtual WORLD_2 automatically upon the teleportation to ROBOT_2 (see section 2.10.1 and 3.2.5).

(d) SUPER objects carry higher points (see section 4.8.2).

1.1.3 Teleportation

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

(a) A team needs to teleport their robots at any time after **3** minutes but before the first 5 minutes passed whilst ending the ROBOT_1's movement. The minimum duration for which ROBOT_1 can move in WORLD_1 is **3** minutes and the maximum duration is **5** minutes.

(b) Teleportation within the first **3** minutes is invalid.

(c) If a team fails to teleport by the end of the first **5** minutes, ROBOT_2 will be activated by the CoSpace server automatically (see section 3.2.4).

(e) 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.

1.1.4 WORLD_2: Virtual

(a) In WORLD_2, ROBOT_2 searches for 4 types of objects, RED, GREEN, BLACK and SUPER objects. ROBOT_2 has to collect and deposit objects 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.

(b)   A set of virtual RED, GREEN and BLACK objects found in WORLD_2 will NOT form a SUPER object.

1.2   Secondary Category

1.2.1   Game Process

A game lasts 8 minutes, with two teams competing in one game. A game consists of two parts known as WORLDs. WORLD_1 is REAL and WORLD_2 is VIRTUAL. A team has one robot in each WORLD as shown in figure 2.

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

A team must program both the real and virtual robots and establish communication between them in order to navigate and collect objects in WORLD_1 and WORLD_2. A team must end the ROBOT_1 and activate the ROBOT_2 (teleportation, see section 1.2.3) while transferring from WORLD_1 to WORLD_2. By successfully teleporting within the 3-5 minute period, the team will be awarded 100 points. If a team fails to teleport within 5 minutes, the robot in WORLD_2 will be automatically activated and the team will not receive 100 points. Teleporting before 3 minutes is invalid.
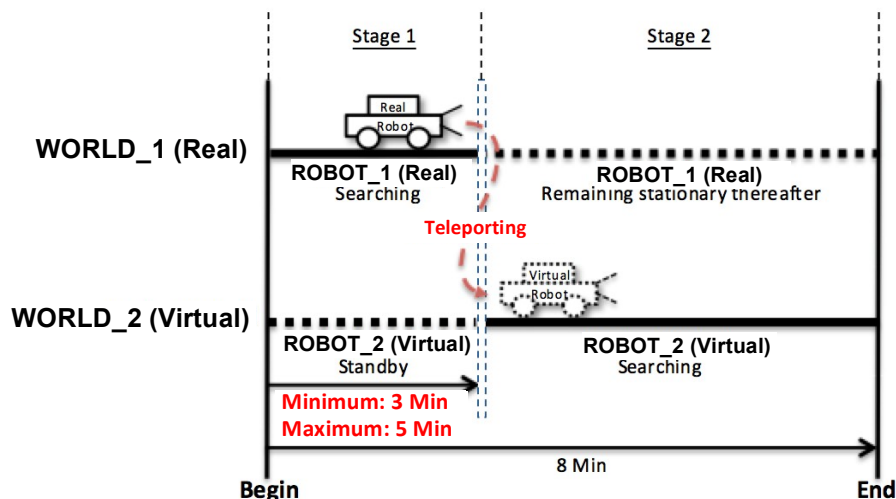

Figure 2: Secondary Category Game Process

1.2.2   WORLD_1: Real

(a)   A game begins with real ROBOT_1 navigating in WORLD_1 (real) while virtual ROBOT_2 is 'standing by' in the virtual WORLD_2 (virtual).

(b)   In WORLD_1, ROBOT_1 searches for 3 types of objects, RED, GREEN, and BLACK objects. ROBOT_1 is not allowed to collect the same object consecutively. ROBOT_1 has to deposit collected objects 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.

(c)   Any one set of RED, GREEN and BLACK objects that is deposited with one single trip to the collection box will form one SUPER object. These SUPER Objects will be transferred to the WORLD_2 automatically upon the teleportation to ROBOT_2 (see section 2.10.1 and 3.2.5).

(d)   SUPER objects carry higher points (see section 4.8.2).

1.2.3   Real/Virtual Worlds Communication and Teleportation

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

(a) A team needs to establish communication between ROBOT_1 (real robot) and ROBOT_2 (virtual robot). A team needs to teleport their robots at any time after **3** minutes but before the first 5 minutes passed whilst ending its ROBOT_1's movement. The minimum duration for which ROBOT_1 can move in WORLD_1 is **3** minutes and the maximum duration is **5** minutes.

(b) Teleportation within the first **3** minutes is invalid.

(c) If a team fails to teleport by the end of the first **5** minutes, ROBOT_2 will be activated by the CoSpace server automatically (see section 3.2.4).

(e) Only one robot can move at any one time. When ROBOT_1 moves in the real world, the ROBOT_2 must be in standby mode. When ROBOT_2 is activated, the ROBOT_1 stops until the end of the game.

1.2.4 WORLD_2: Virtual

(a) In WORLD_2, ROBOT_2 searches for 4 types of objects, RED, GREEN, BLACK and SUPER objects. ROBOT_2 has to deposit collected objects 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.

(b) One set of virtual RED, GREEN and BLACK objects found in virtual world will NOT form a SUPER object.

2. ARENA (Secondary & Primary)

2.1 Layout

2.1.1 The game takes place in two virtual worlds for primary category, and one real and one virtual world for the secondary category. Appendix A shows the layout of virtual world 1 and virtual world 2 for the Primary category. Appendix B shows the layout of the real world and virtual world for Secondary category.

2.1.2 Both real and virtual worlds contain obstacles, traps, object collection boxes and objects. They may contain special zones and swamplands (for secondary only). (See section 2.6 and 2.7)

2.2 Dimensions

2.2.1 Primary category

The dimensions of WORLD_1 are 180cm x 240cm. The dimensions of WORLD_2 are 270cm x 360cm.

2.2.2 Secondary category

The dimensions of WORLD_1 (real) are 180cm x 240cm (see Appendix C for building instruction). The dimensions of WORLD_2 (virtual) are 270cm x 360cm.

2.3 Floor

2.3.1 Primary Category

The floor of both WORLD_1 and WORLD_2 is generally white.

2.3.2 Secondary Category

(a) WORLD_1 (Real World):

- The floor of WORLD_1 (real) is generally white. The floor may be either smooth or textured (same as Rescue A arena).

- The outer edge of the real world setup is covered with 10cm wide yellow boundary (see Appendix B). The yellow boundary serves as the warning area and it is used to prevent the real robot from moving out of the real world.
- The real world will be placed so that the floor is level.

(b) WORLD_2 (Virtual World):

- The virtual world is a 3D simulated environment (Refer to appendix B). The floor is light colour, such as white, light green, light blue, etc.

2.4 Lines

2.4.1 There may be lines of width 4 cm in the virtual/real world. The lines can be used to guide virtual/real robot towards the object collection box and the special zone.

2.5 Obstacles

2.5.1 Obstacles found in both worlds can be of any size, and have minimum dimensions of 10cm x10cm x10cm.

2.6 Special Zones

2.6.1 Certain areas in the virtual/real world are designated as special zones. Any 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.
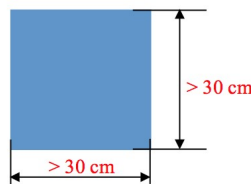

Figure 3: Special Zone

2.7 Swamplands (only available in the virtual world for the secondary category)

2.7.1 Certain areas in the virtual world are designated as swamplands. The swampland is light grey in colour as shown in Figure 4. The swampland can be any size bigger than 30cm x 30cm. The motor power will be reduced by 80% if the robot falls into swamplands.
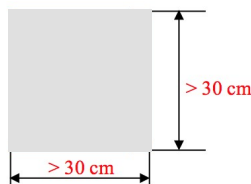

Figure 4: Swampland

2.8 Traps

2.8.1 Traps are 10cm x 10cm and are surrounded by a Yellow warning area. If a robot goes over a trap it will lose any objects it is currently carrying.
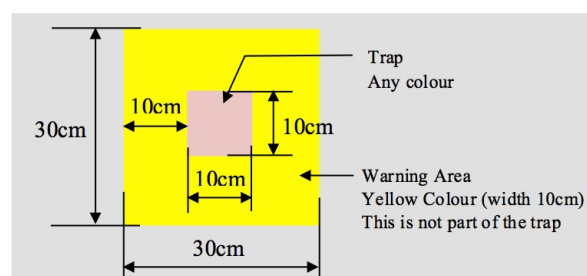

Figure 5: Trap

2.9   Objects

2.9.1   Objects will be located in random positions throughout the course. There are FOUR types of objects, RED, GREEN, BLACK, and SUPER objects. The minimum diameter and colour of each object are shown in Figure 6. The thickness of each object is less than 2mm. The objects can be any shape.

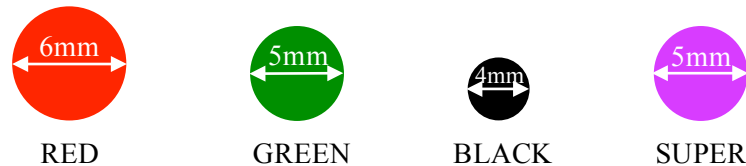| 6mm | 5mm | 4mm | 5mm |
| RED | GREEN | BLACK | SUPER |

Figure 6: Various objects

2.9.2   Each type of objects has different value (see section 4.8.2).

2.10   SUPER Objects

SUPER objects can be created in two ways:

2.10.1   For every set of RED, GREEN and BLACK objects collected and deposited (in one single trip to the deposition area) in World 1 generates a purple SUPER Object that will be placed in World 2. The SUPER Object will be placed directly in front of the team's robot:
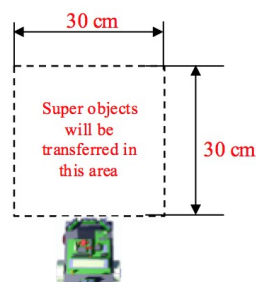

Figure 7: Location of Super Objects transferred from Stage 1

2.10.2   There are also SUPER Objects located randomly in World 2. Information as to the location of the SUPER Object will be given to the teams' robot:

(a) Primary Category:

The randomly created SUPER Objects will be placed on the lines which are 15 cm away from the wall (see Appendix A). The line reference number (Line 1, 2, 3, or 4) will be sent to the virtual ROBOT_2 upon the SUPER objects' creation.

(b) Secondary Category

The CoSpace server will send the randomly generated (X,Y) coordinates of the Super Objects to both teams' virtual robots (ROBOT_2) upon SUPER objects' creation. (See Figure 8)
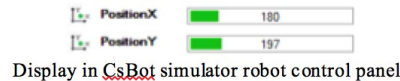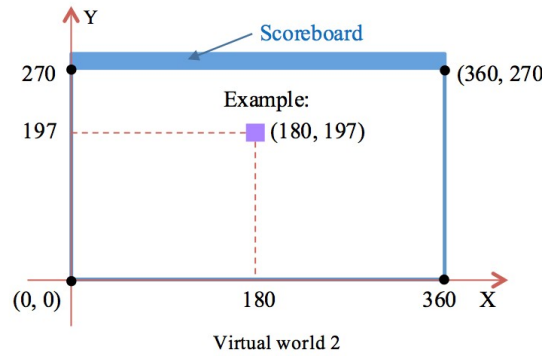
Figure 8: X & Y coordinate system for virtual world 2

2.11 Object Collection Boxes

2.11.1 Figure 9 shows the object collection box. The collection box is ORANGE in colour. The dimensions are 30m x 30cm.
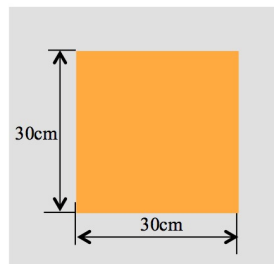

Figure 9: Object collection boxes

2.12 Lighting

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

2.12.2 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 organisers to strictly control factors outside of the real world. Teams are strongly encouraged to program their real robots so that sudden changes (eg. camera flash) do not cause major problems.

2.12.3 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.

3. ROBOTS

In RCJ2014, the organizer will provide the real robots (standard platform) for secondary teams during the competition. ZigBee communication protocol is used in the CoSpace robot platform for establishing the real/virtual robot communication. Self-built robots are not allowed.

3.1 Control

3.1.1 Virtual/real robots must be controlled autonomously, but started manually by humans.

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

3.2 Communication

3.2.1 The minimum duration of ROBOT_1 movement is **3 minutes** and maximum duration is **5 minutes**. A team can teleport their robots from WORLD_1 to WORLD_2 at any time within this period.

3.2.2 Teleportation within the first **3 minutes** is invalid.

3.2.3 100 points will be awarded for a successful communication and teleportation (see section 4.8.3).

3.2.4 If a team fails to transport within the first **5** minutes, the CoSpace server will stop ROBOT_1 and activate ROBOT_2 automatically.

3.2.5 The Team's SUPER objects will be transferred to the WORLD_2 when the team's ROBOT_2 is activated. The SUPER objects will be placed near to the ROBOT_2 (see section 2.10.1).

3.3 Coordinates Notification (only available in WORLD_2 for the Secondary category)

3.3.1 The server will send a robot its own coordinate in the virtual world. However, this information will be blocked by the CoSpace server randomly during the competition.

4. GAMEPLAY

4.1 Pre-setup

4.1.1 The layout of both WORLD_1 and WORLD_2 will be released to teams prior to the tournament.

4.2 Pre-round Practice

4.2.1 Wherever possible, 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.

4.3 Humans

4.3.1 As the space around the competition fields is limited (and crowds can result in accidents to robots) teams should designate one member who will act as "captain" and be allowed to move the real robot, based on the stated rules and as directed by the referee.

4.3.2 The "captain" can move the real robot only when directed to by the referee.

4.3.3 Other team members (and any spectators) within the vicinity of the real world are to stand at least 150 cm (approximately 60 inches) away from the real world while their real robot is active, unless otherwise directed by the referee.

4.4 Game Procedure

4.4.1 A game coordinator is an official who receives and uploads teams' programs as well as runs the games.

4.4.2 Teams should report to the registration counter at least 5 minutes before their game starts. Teams can be penalized by 20 points per minute at the Referee's discretion if they are late for the game start (teams will be given 100 points at the beginning of the game). Teams that are 5 minutes late for the time of their game will forfeit the round; therefore, the opponent will gain 500 points and be declared the winner.

4.5   Pre-match Meeting

4.5.1   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 of which determines the colour the teams use.

4.6   Interview

4.6.1   It is compulsory for team to attend the interview. Teams may take the interview score sheet for reference while preparing their interview.

4.7   Start of Play

4.7.1   Pre-game task (Note: Rule 4.7.1 applies specifically for the World Championship)

It is compulsory for teams to complete a pre-game task. A programming task will be released on site. Teams are not allowed to bring a pre-written program to attempt the task.   For the duration of this task, teams will not be allowed to consult with mentors, or other students outside of their team. The purpose of this is to check that the team members have solved the task rather than the mentors.

4.7.2   Real game (Secondary category)

Teams should program and download it onto the real robot before the real game. The team "captain" is responsible for placing the real robot in the real world and starting the robot manually. It is the teams responsibility to ensure that the correct program is downloaded to the correct robot.

4.7.3   Virtual game

Teams should give their program to the game coordinator 10 minutes before the game starts. The game coordinator 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.

4.8   Scoring

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

4.8.2   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 colour sensor has detected the object.*

The points for collecting different objects are as follows:

Object Type	Points in real world (Secondary only)		Points in virtual world	
	Regular Zone	Special Zone	Regular Zone	Special Zone
RED	20	40	10	20
GREEN	30	60	15	30
BLACK	40	80	20	40
SUPER	N/A	NA	120	240

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

(b)   Objects in the real world will NOT disappear after it is collected. It is team's responsibility to move their real robot away from the real object and search for others.

(c)   Objects in the virtual world will disappear after it is collected.

4.8.3 Communication

Teams are given 100 points for successful teleportation.

4.8.4 Depositing objects

When a robot successfully deposited an object in the collection box and exited the deposition area, the points of the objects deposited will be doubled. If the robot gets stuck, the points will not be doubled.

A robot must stop and turn on the LED for 3 seconds (with a steady light) to indicate that it deposited an object. A robot is only considered to be in the collection box when both colour sensors detect the collection box.

4.8.5 Falling Into a Trap

If a virtual/real robot falls into a trap (see section 2.8), the robot will be frozen for 10 seconds, then be placed at the starting point. All objects that have been collected but not yet placed in the object collection box (see section 2.11) 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 has detected the trap.

4.8.6 Falling Into a Swampland **(for secondary category virtual world only, see section 2.7)**

If a robot falls into a swampland, 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 colour sensor has detected the swampland.

4.8.7 Game Points

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

Game	GAME POINTS
Win	3
Draw	1
Loss	0

4.8.8 Winner

(a) Round Robin

- The winner of the round robin is determined based on the following:

  Points from pre-game task: 15%
  Points from interview: 15%
  Total points from round robin games: 70%

- If two teams gained the same total points, the winner will be decided based on the pre-game result. If the pre-game results are still the same, the winner will be decided based on the total round robin game points.

(b) Quarter-Finals, Semi-finals and Final

- The winner of the semi-finals and final will be decided solely based on the semi-final/final game result.

- If the match points are the same for two competing teams, the winner will be decided based on the total game points. If the total game points are still the same, the team with the higher points in WORLD_2 (virtual) will be the winner.

4.9 Human Interference

4.9.1   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 violating team can be disqualified from the game.

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

4.10 Lack of Progress

4.10.1   Lack of progress occurs when there is no progress in a game play for 10 seconds and the situation is not likely to change. A typical lack of progress situation is when a real/virtual robot is stuck. The referee will call "lack of progress" and will move the robot to a different location but close to where it was located.

4.10.2   A team may decide to stop a round early if the lack of progress cannot be resolved. 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.

4.11 Penalty

4.11.1   It is compulsory for teams to specify the team name in virtual games. Teams will be given a yellow card if they failed to do so for the first time. A red card will be given if the team fails to add the team name for the second time in a virtual game.

4.11.2   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.

4.11.3   If two virtual/real robots bump into each other, both robots will be separated from each other and repositions 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.

4.11.4   For the Secondary Category, if a real robot moves out of the yellow boundary, a referee will move it inside the boundary. The real robot will be frozen for 10 seconds. There will be no point deduction.

4.11.5   If a robot repeats its action for at least 10 seconds (looping – one type of "lack of progress"), team captain can request to move the robot to a different location but close from where it was located. However, the robot will be frozen for 10 seconds after relocation.

4.12 Interruption of Game

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

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

4.12.3   The referee can stop 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.

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

5.   CONFLICT RESOLUTION

5.1 Referee

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

5.2 Rule Clarification

5.2.1   Rule clarification may be made by the members of the RoboCupJunior CoSpace Technical Committee.

5.3   Special Circumstances

5.3.1   Specific modifications to the rules to accommodate special circumstances, such as unforeseen problems and/or capabilities of a team's robot, may be agreed upon at the time of the tournament when majority of the contestants agree with the proposed modifications.

6.   DOCUMENTATION

6.1   Presentation

6.1.1   Each team must bring a presentation (e.g. journal, PowerPoint or any other format) and/or an A3 poster. The presentation should provide information about the team and how they prepared for RoboCupJunior. Areas that could be covered include:

- Team name;

- Team members' names and (perhaps) a picture of the team members;

- Team's country and location within country;

- Team's school and district;

- Development of the searching and placement strategies.

- Pictures of the robot under development (if any) and sample code,

- Any interesting or unusual features of their programs;

- What the team hopes to achieve in robotics.

6.1.2   Presentations and/or posters are to be shown to the judges during the scheduled interview session.

6.1.3   Teams are requested to provide a digital version of their presentation and poster.

6.1.4   Prizes may be awarded to teams with outstanding presentations.

6.2   Sharing

6.2.1   Teams are encouraged to view one another's posters and presentations.

7.   CODE OF CONDUCT

7.1   Fair Play

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

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

7.2   Behaviour

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

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

7.2.3   Participants should be mindful of other people and their robots when moving around the tournament venue.

7.2.4   Participants are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by team members.

7.2.5   Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.

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

7.2.7 Mentors (teachers, parents, chaperones, translators, and other adult team members) are not allowed in the student work area.

7.2.8 Mentors are not allowed to be involved in programming of students' robots.

7.2.9 Mentor interference with robots or referee decisions will result in a warning in the first instance. If this reoccurs, the team will risk being disqualified.

7.3 Sharing

7.3.1 The understanding that any technological and curricular developments should be shared among the RoboCup and RoboCupJunior participants after the tournament has been a part of world RoboCup competitions

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

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

7.4 Spirit

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

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

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

7.4.4 Queries regarding these rules or their interpretation may be sent to the CoSpace Technical Committee, Shen Jiayao (Singapore), at jyshen@sp.edu.sg .

Further Information about CoSpace Robotics

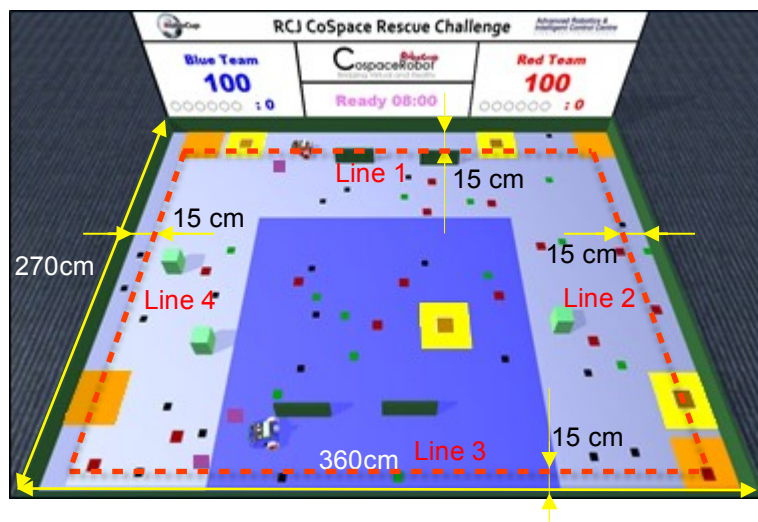CoSpace Robot Home Page: www.CoSpaceRobot.org

Appendix A: Primary Category Competition Setup

WORLD_1 (Virtual):
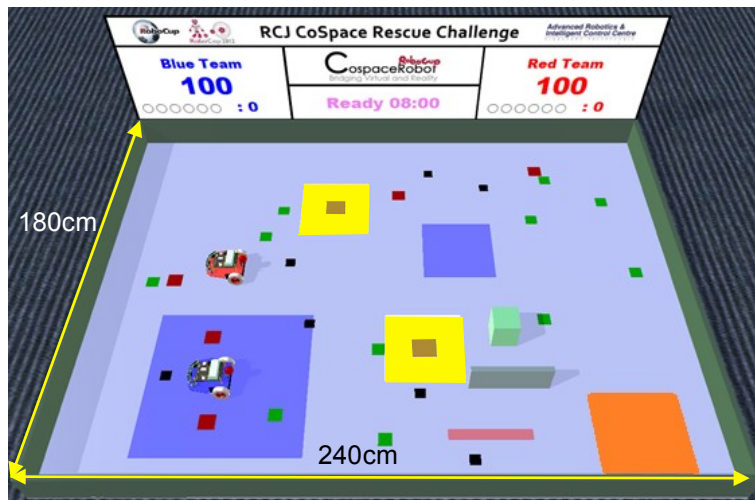
- The location (X&Y coordinates) of any objects including virtual robot, all objects to be collected, special zones, traps, guide lines, collection boxes, and obstacles will not be disclosed to teams before or during a game.
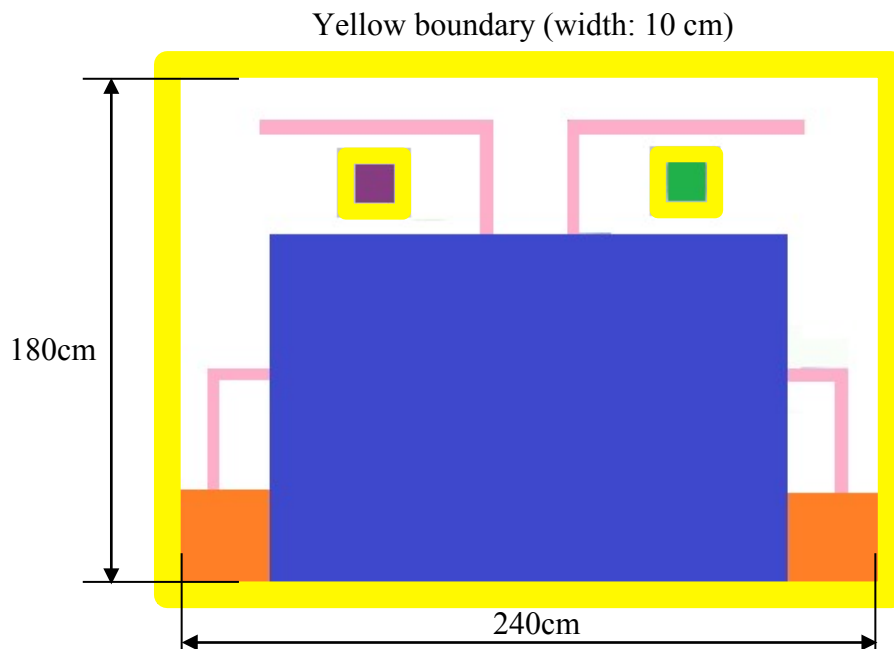
WORLD_2 (Virtual):

- The location (X & Y coordinates) of any objects including virtual robot, all objects to be collected, special zones, traps, guide lines, collection boxes, and obstacles will not be disclosed to teams before or during a game.

- The transferred Super objects will be placed in front of ROBOT_2 but no information of the X & Y coordinates will be disclosed to teams.

- The coordinates of the SUPER objects randomly created by the CoSpace server will be placed 15cm away from the wall (indicated by the dash-lines in the diagram; however, the dash-line will not be shown in the virtual world 2).

Appendix B: Secondary Category Competition Setup

WORLD_1 (Real):

Yellow boundary (width: 10 cm)

- The location (X& Y coordinates) of any objects including real robot, real objects to be collected, special zones, traps, guide lines, collection boxes, and obstacles will not be disclosed to teams before or during a game.

**WORLD_2 (Virtual - this will be changed later)**

- The location (X & Y coordinates) of any objects including all objects to be collected, special zones, traps, guide lines, collection boxes, and obstacles will not be disclosed to teams before or during a game.

- The X & Y coordinates of virtual robots will be provided to teams.

- The transferred Super objects will be placed in front of ROBOT_2 but no information of the X & Y coordinates will be disclosed to teams.

- The X & Y coordinates of the SUPER objects randomly created by the CoSpace server will be provided to teams.

Appendix C: Secondary Category Competition - Real World Suggested Building Instruction

The following is the suggested instruction for building the real world for CoSpace Rescue Secondary category.

1. Cut a piece of 240cm x 300cm plywood or fibreboard (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.

2. Lay the board on the floor. The floor should be level.

3. Paint the surface to white colour.

4. Paste the yellow warning boundary on the board.
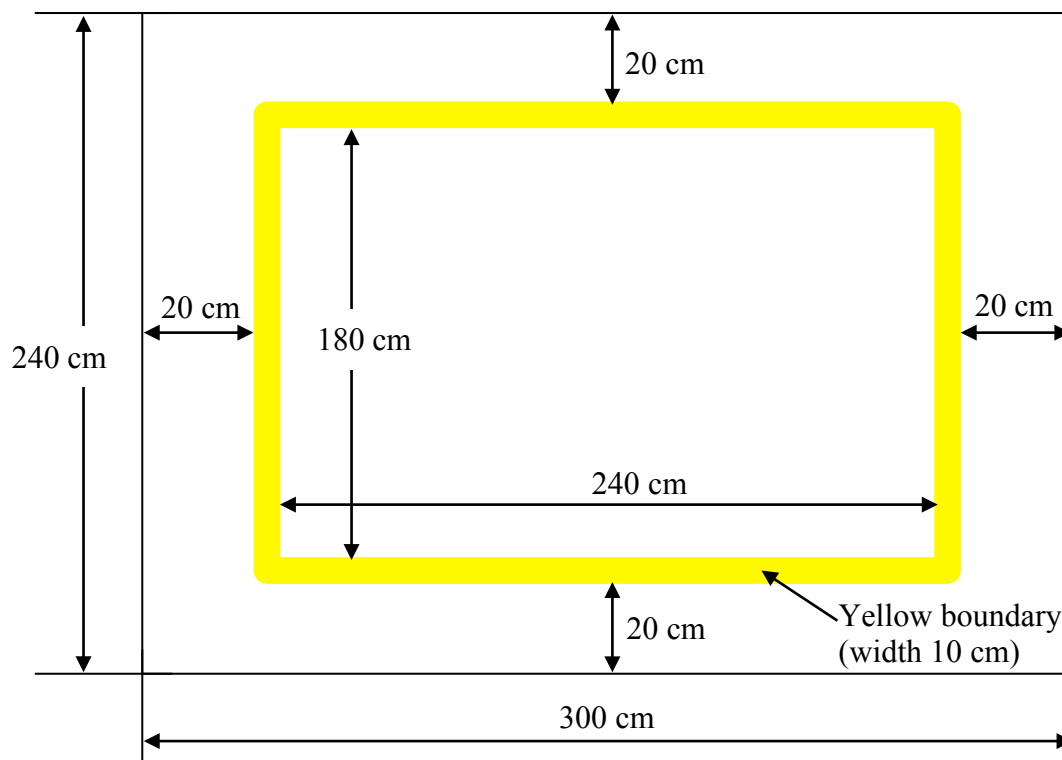
If the field is not placed on the floor, a simple frame should be added at the edge to prevent the robot from falling.