



## RoboCupJunior CoSpace Rescue (Demo) Rules 2012

RoboCupJunior CoSpace Demonstrations Technical Committee 2012:

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**This document contains the official rules for RoboCupJunior – CoSpace Rescue (Demo) event for RoboCupJunior 2012. This document is released by the RoboCupJunior CoSpace Technical Committee. The rules contained in this document have priority over any translations. Differences between RoboCupJunior CoSpace Rescue (Demo) 2011 and RoboCupJunior CoSpace Rescue (Demo) 2012 are highlighted in red.**

### PREFACE

In CoSpace Rescue (Demo), a team has to develop appropriate strategies for a virtual autonomous robot to navigate through the virtual arena and collect objects in the 3D virtual environment while competing with another robot that is performing the same mission. The strategies need to be also applied to a real robot to complete the same task in the real world.

### GENERAL RULES

#### 1. ARENA

##### 1.1 Layout

- 1.1.1 There are two competition arenas – the virtual and the real arenas. **The sample arenas are shown in appendix A.**
- 1.1.2 Both arenas contain obstacles, special zones, traps, **object collection** boxes, and **objects**.
- 1.1.3 **The virtual arena** is for a virtual robot to search **objects** in the virtual environment. **The real arena** is for a real robot to search **objects** in the real world.



## 1.2 Dimension

- 1.2.1 The dimension of both virtual and real arenas is about 180cm x 240cm. (The size can be the same as the RCJ Soccer B field).

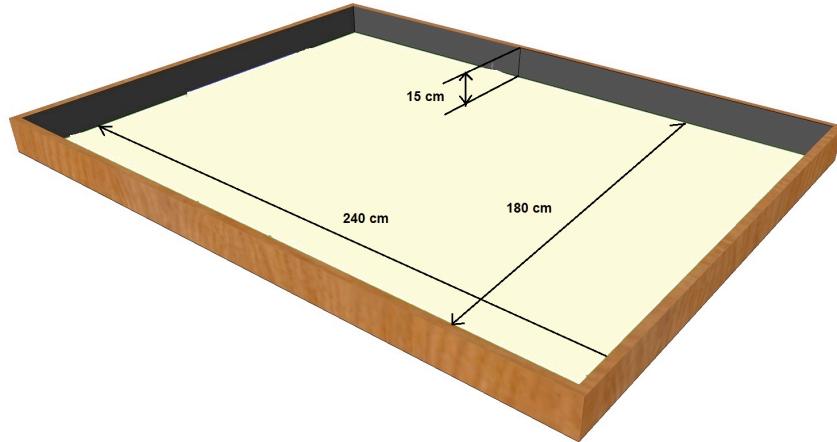


Figure 1: Competition arena

## 1.3 Floor

- 1.3.1 The floor of the virtual/real arena will be light colored, white or light gray in general. The floor may be either smooth or textured (same as Rescue A arena).
- 1.3.2 The real arena will be placed so that the floor is level.

## 1.4 Line

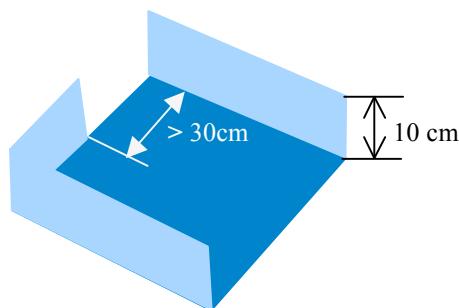
- 1.4.1 There will be 4 cm width lines in the virtual/real arena. The lines are used to guide virtual/real robot towards the **object collection** box and special zone.

## 1.5 Obstacles

- 1.5.1 The obstacles, such as buildings or other similar blocks, will be in the shape of cube or cylinder with height of 10 cm in the virtual/real arena.

## 1.6 Special Zones

- 1.6.1 Certain areas in virtual/real arena are designated as special zones. The special zone is blue in colour and surrounded by a wall with height of 10cm as shown in figure 2. **The special zone can be any size bigger than 40cm x 40cm.**



## 1.7 Traps

- 1.7.1 The size of trap is 10cm x 10cm. The trap is surrounded with a silver warning area. Figure 3 shows an example of the traps.

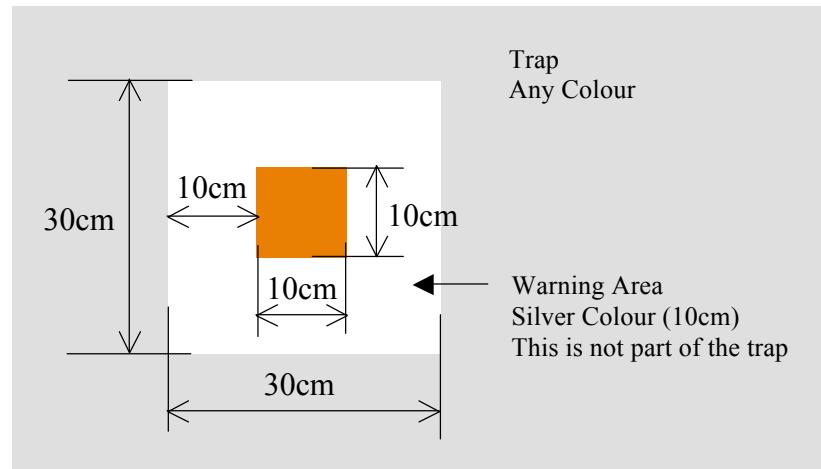


Figure 3: Trap

## 1.8 Object Collection Boxes

- 1.8.1 There are 3 types of object collection boxes. The size is 30cm x 30cm.
- 1.8.2 The mixed object collection box shown in figure 4(a) is for storing red and black objects.
- 1.8.3 The black object collection box shown in figure 4(b) is only for storing the black objects.
- 1.8.4 The red object collection box shown in figure 4(c) is only for storing the red objects.

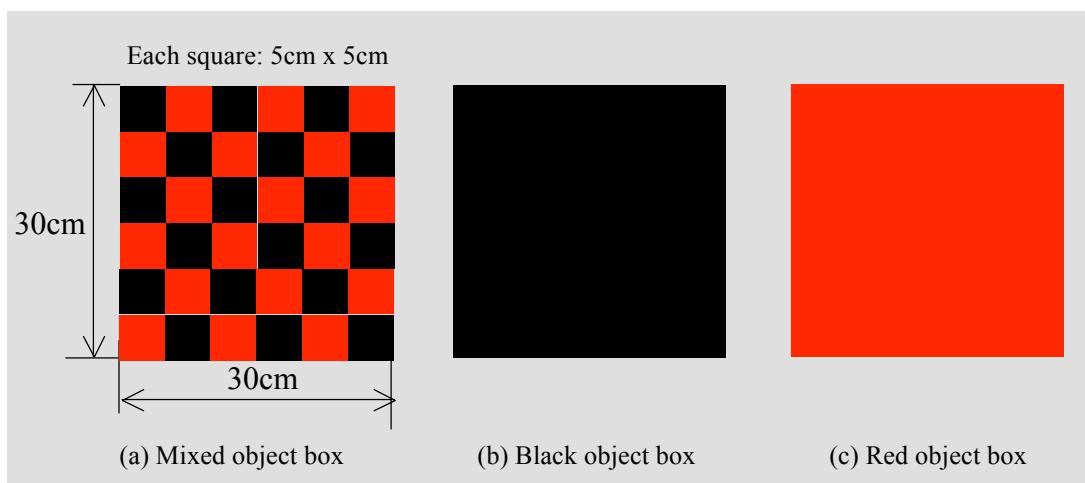


Figure 4: Object collection boxes



## 1.9 Objects

- 1.9.1 Objects will be located in random positions throughout the course. There will be two types of objects as shown in figure 5. The size of the BLACK object is 4 cm x 4 cm. The size of the RED object is 5.5 cm x 5.5 cm. The thickness of each object is less than 2mm.

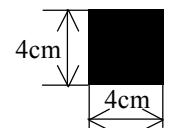
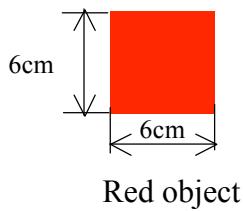


Figure 5: Objects

## 1.10 Lighting

- 1.10.1 The lighting condition for the virtual/real arena will be varied. Teams must be able to perform calibration in order to complete the mission.
- 1.10.2 Picture taking by spectators might introduce IR and visible light into the real arena and to the real robots. Whilst efforts will be made to limit this, it is not possible for organisers to strictly control factors outside of the real competition arena. Teams are strongly encouraged to program their real robots so that sudden changes (eg. camera flash) do not cause major problems. This is good practice in all robotics, both in competitions and in real life situations.
- 1.10.3 Every effort will be made by the organizers to locate the real arena away from magnetic fields such as under-floor wiring and metallic objects. However, sometimes this cannot be avoided.

Hint: If a team decides to build its own robot, it is recommended the robot should be able to cope with variations in lighting and magnetic conditions, as these vary from venue to venue. Teams should come prepared to calibrate their robots based on the conditions at the venue.

## 2. ROBOTS

### 2.1 Control

- 2.1.1 Virtual/real robots must be controlled autonomously.
- 2.1.2 Virtual/real robots must be started manually by humans.
- 2.1.3 The use of a remote control to manually control virtual/real robots is not allowed.
- 2.1.4 BlueTooth Class 2 or Zigbee communication between real and virtual robot is permitted. No other form of radio communication is allowed. Robots that have radio



communications on board, whether they are used during the duration of the competition or not, will be immediately disqualified

- 2.1.5 In each round, robots deployed must perform their tasks autonomously.

### 3. GAME PLAY

#### 3.1 Pre-setup

- 3.1.1 Both real and virtual competition arenas will be released prior to the tournament.

#### 3.2 Pre-round Practice

- 3.2.1 Wherever possible, competitors will have access to a practice field for calibration. Teams can calibrate their sensors **ONLY** before a game. Calibration is defined as the taking of sensor readings and modifying real robot program to accommodate such sensor readings. Calibration can be done in as many locations as desired.

#### 3.3 Humans

- 3.3.1 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.
- 3.3.2 The "captain" can move the real robot only when directed by the referee.
- 3.3.3 Other team members (and any spectators) within the vicinity of the real arena are to stand at least 150 cm (approximately 60 inches) away from the real arena while their real robot is active, unless otherwise directed by the referee.

#### 3.4 Game Procedure and Length of a Game

- 3.4.1 A game coordinator is an official who receives and uploads teams' programs as well as runs the games.
- 3.4.2 A game consists of two halves. The duration of each half is 6 minutes. There is a 6 minutes break after the first half. The game clock continues to run for the duration of the halves without stopping except in the case whereby the referee wants to consult an official.
- 3.4.3 Each match comprises a virtual game and a real game. Each team plays both virtual and real games per match.
- 3.4.4 Teams should report to the registration counter at least 5 minutes before their game starts. Teams can be penalized by 20 scores per minute at the Referee's discretion if they are late for the game start (Team will be given 100 scores at the beginning of the game). **Teams that are late for their starting time for 5 minutes will forfeit the round.** Therefore, the opponent will gain 500 scores and be declared as the winner.

#### 3.5 Pre-match Meeting



- 3.5.1 Each team will be assigned a **team colour** (blue or red). At the start of the first half of the game, the referee will toss a coin. The winner of the toss can choose the colour for their team.

### 3.6 Start of Play

- 3.6.1 Virtual competition

Teams should give their program to the game coordinator before each half of a virtual game. Teams **may** modify the programs **only** during a break. The game coordinator will upload the programs in the competition server, place the team's robot in the starting point in the virtual arena and start the competition.

- 3.6.2 Real competition

The team "captain" is responsible for placing the real robot in the real arena and starting the robot manually.

### 3.7 Scoring

- 3.7.1 **A team can gain game scores by collecting and placing the objects into the collection boxes.**

**Collecting the objects** means that a robot stops and flashes the lamp for 3 seconds when it detects the objects.

**Placing the objects into the collection box** means a robot stops and turns on the lamp for 3 seconds (steady light) when both colour sensors detected the collection box.

- 3.7.2 Team will be given 100 scores at the beginning of each game.

- 3.7.3 **A real/virtual robot must indicate that it has found a object by stopping and flashing a lamp for 3 seconds.**

- 3.7.4 Each **red object** is worth 10 scores and each black object is worth 20 scores.

- 3.7.5 Each **red object** is worth 20 scores and each black object is worth 40 scores in the special zone (see section 1.6).

- 3.7.6 If the virtual/real robot falls into the trap (see section 1.7), all **objects** collected **that** have not yet placed in the **object collection** box (see section 1.8) will disappear. Therefore, the scores awarded for those **objects** collected will be deducted.

*A virtual/real robot is considered to be in the trap if any one of the colour sensors has detected the trap (the colour patch).*

- 3.7.7 The robot needs to send the **objects** to the **object collection** box (see section 1.8). The score will be doubled upon successful placement of the objects in the collection box.

*A robot is considered successfully placed the objects in the collection box when two colour sensors detected the collection box and the lamp was on for 3 seconds(steady light).*



- 3.7.8 A real/virtual robot cannot collect more than the maximum number of objects defined by the OC without placing them in the collection box. The maximum number will be announced on-site.
  - 3.7.9 Real/virtual robots are penalized 10 scores for a lack of progress (see section 3.9).
  - 3.7.10 If a robot got stuck after placing the collected object in the collection box, the robot will not be able to obtain the double points for placing their objects in the collection box.
- 3.7.11 After each game, following game points will be given accordingly.

| Game | Point |
|------|-------|
| Win  | 3     |
| Draw | 1     |
| Loss | 0     |

- 3.7.12 A match point = virtual game point + real game point
- 3.7.13 If the match points are the same for two competing teams, the winner will be decided based on the total game score (virtual game score + virtual game score). If the total game score are still the same, the team with the higher virtual game score will be the winner.

### 3.8 Human Interference

- 3.8.1 Except for a lack of progress, human interference (e.g. re-locate the real/virtual robot to any reset scores) during the game is not allowed unless permitted by the referee. A violating team can be disqualified from the game.

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

### 3.9 Lack of Progress

- 3.9.1 Lack of progress occurs when there is no progress in the 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 real/virtual robot to the nearest reset point. If this does not solve the lack of progress, the referee can move the real/virtual robot to a different reset point. (Also refer to 3.7.9 for the score deduction)
- 3.9.2 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 scores achieved.

### 3.10 Penalty



- 3.10.1 If a virtual/real robot is hit/attacked by another virtual/real robot, the attacking robot will be placed at the starting point. The attacking team will be penalized by deduction of 20 scores.
- 3.10.2 If two virtual/real robots bump into each other, both robots will be placed at the starting point. 10 scores will be deducted for both teams.

### **3.11 Interruption of Game**

- 3.11.1 In principle, a game will not be stopped in the middle.
- 3.11.2 The referee can end the game if all **objects** have been picked up by the teams.
- 3.11.3 The referee can stop the game if there is a situation on or around the field when the game coordinator/referee wants to discuss with an official of the tournament. Game will be re-run in this case.

## **4. CONFLICT RESOLUTION**

### **4.1 Referee**

- 4.1.1 During a game play, the referee's decision is final.

### **4.2 Rule Clarification**

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

### **4.3 Special Circumstances**

- 4.2.1 Specific modifications to the rules to allow for special circumstances, such as unforeseen problems and/or capabilities of a team's robot, may be agreed to at the time of the tournament, provided a majority of the contestants agree.

## **5. DOCUMENTATION**

### **5.1 Presentation**

- 5.1.1 Each team must bring an electronic presentation (e.g. in PowerPoint or Flash 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 the robot;
  - What the team hopes to achieve in robotics.
- 5.1.2 Presentations and/or posters are to be shown to the judges during the scheduled interview session.
- 5.1.3 Judges will review the presentation and discuss the contents with team members.
- 5.1.4 Competitors are requested to provide a digital version of their presentation and poster.
- 5.1.5 Prizes may be awarded to teams with outstanding presentations.
- 5.2 Sharing**
- 5.2.1 Teams are encouraged to view one another's posters and presentations.

## **6. CODE OF CONDUCT**

### **6.1 Fair Play**

- 6.1.1 Robots that cause deliberate or repeated damage to the arena will be disqualified.
- 6.1.2 Humans that cause deliberate interference with robots or damage to the arena will be disqualified.
- 6.1.3 It is expected that the aim of all teams is to participate fairly.

### **6.2 Behaviour**

- 6.2.1 Both teams will be disqualified if the program of one team is copies from the other team.
- 6.2.2 Participants should be mindful of other people and their robots when moving around the tournament venue.
- 6.2.3 Participants are not to enter setup areas of other leagues or other teams, unless expressly invited to do so by team members.
- 6.2.4 Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.
- 6.2.5 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

### **6.3 Mentors**

- 6.3.1 Mentors (teachers, parents, chaperones and other adult team members) are not allowed in the student work area.
- 6.3.2 Mentors are not to repair robots or be involved in programming of students' robots.
- 6.3.3 Mentor interference with robots or referee decisions will result in a warning in the first instance. If this recurs, the team will risk being disqualified.



#### **6.4 Sharing**

- 6.4.1 An understanding that has been a part of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the competition.
- 6.4.2 Any developments may be published on the RoboCupJunior website after the event.
- 6.4.3 This furthers the mission of RoboCupJunior as an educational initiative.

#### **6.5 Spirit**

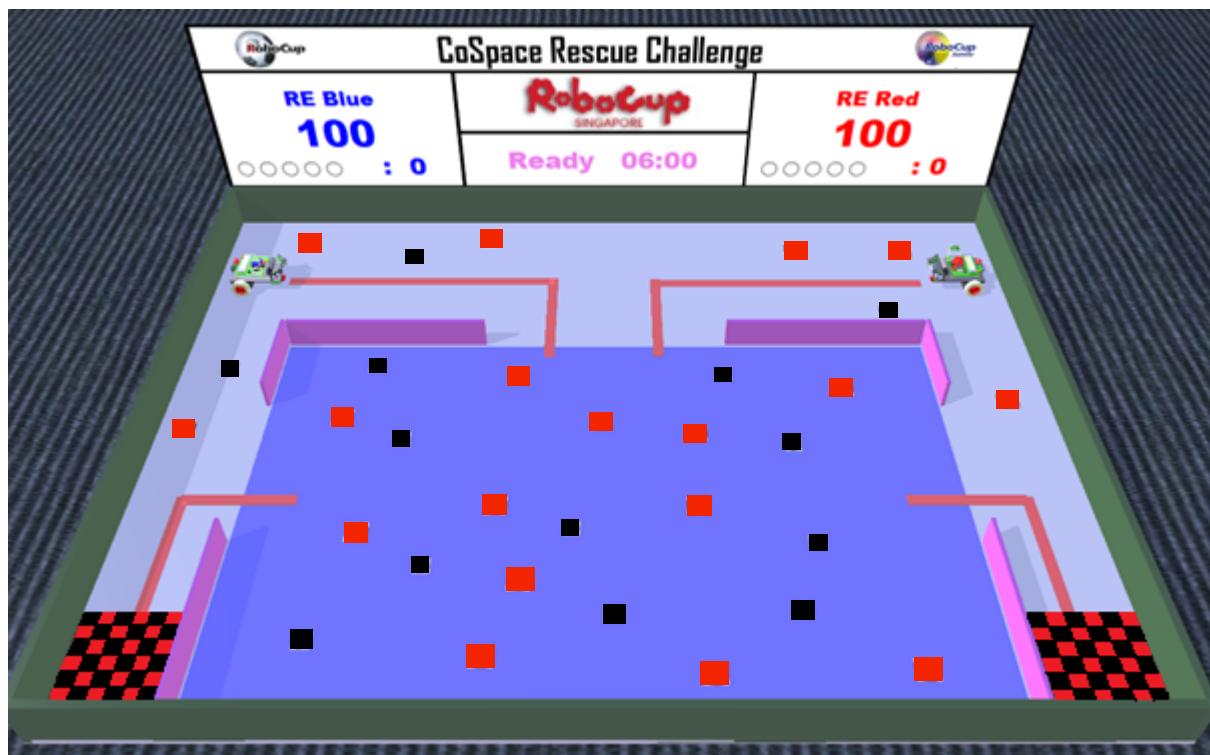
- 6.5.1 It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.
- 6.5.2 The referees and officials will act within the spirit of the event.
- 6.5.3 It is not whether you win or lose, but how much you learn that counts!

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



## Appendix A:

Virtual Arena:



Real Arena:

