RoboCupJunior CoSpace Rescue (Demo) Rules 2011

OBJECTIVE

RoboCupJunior CoSpace Rescue Challenge is an educational initiative to promote knowledge and skills in engineering design, programming, electronic control, and the 3D simulation through robotics for young minds. The CoSpace Challenge aims to fuse real and virtual robotic technologies towards bridging two prominent areas of the future namely, Interactive Digital Media and Robotics.

The main theme of the RoboCupJunior CoSpace Rescue Challenge for RCJ2011 is Treasure Hunting.

PREFACE

In CoSpace Rescue (Demo) Challenge – treasure hunt challenge, a treasure map with a list of treasures will be provided to each participating team. The team has to develop appropriate strategies for a virtual autonomous robot to navigate through the treacherous terrain by avoiding obstacles and collecting treasures in the 3D virtual environment while competing with another robot that is performing the same mission. The strategies will then be applied to a real robot to search the treasures in the real world.

GENERAL RULES

1. ARENA

1.1 Description

1.1.1 There are two competition arenas (treacherous terrains) – the virtual treacherous terrain and the real treacherous terrain.

1.1.2 Both arenas contain obstacles, special zones, traps, treasure boxes, and treasures.

1.1.3 The virtual treacherous terrain (virtual arena) is for a virtual robot to search treasures in the virtual environment. The real treacherous terrain (real arena) is for a real robot to search treasures in the real world.

1.2 Dimension

1.2.1 The dimension of both virtual and real arenas is about 182cm x 243cm. Figure 1 shows the layout of both competition arenas.

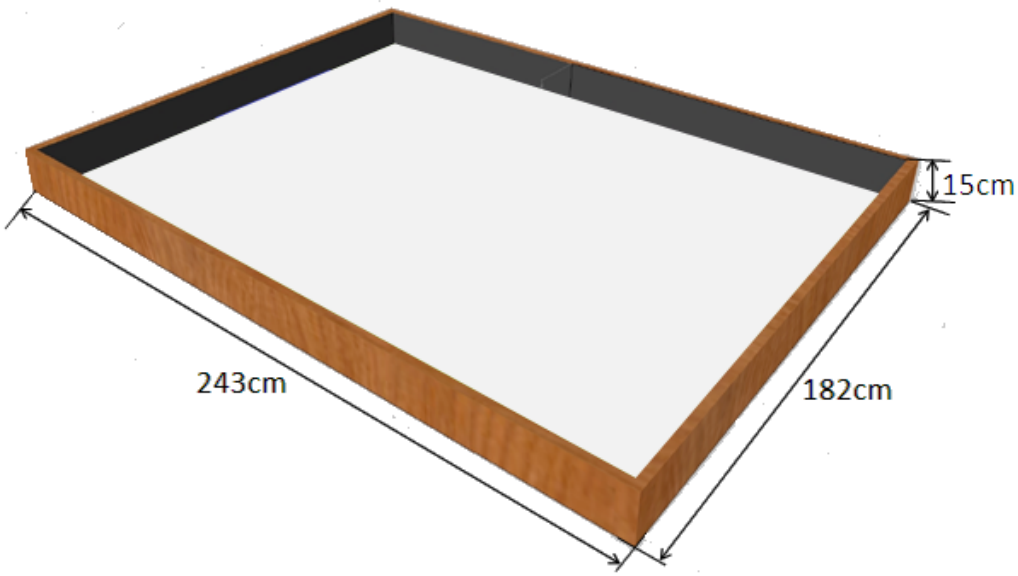

Figure 1: Competition

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 as roads in the treacherous terrain. The lines are used to guide virtual/real robot towards the treasure 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 Zone

1.6.1 Certain areas in virtual/real arena are designated as special zones. The special zone is blue colour and surrounded by a wall with height of 10cm. Figure 2 shows an example of a special zone. When the treasures in the special zone are collected, the points awarded will be doubled. Refer to section 3.7.

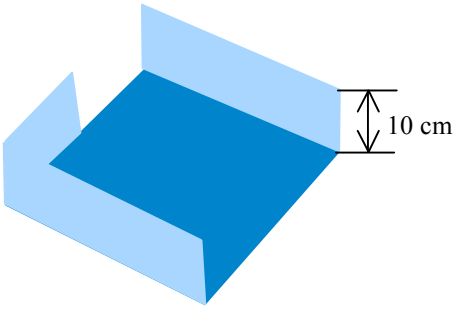

Figure 2: Special Zone

1.7 Traps

1.7.1 Certain areas in the virtual/real arena are designated as traps. Figure 3 shows an example of the traps.

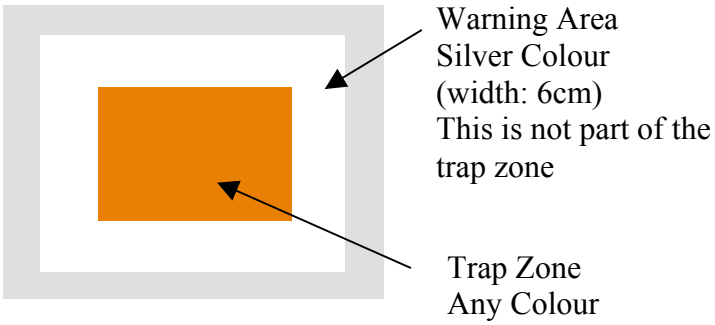

Figure 3: Trap

When a virtual/real robot moves into the trap, all treasures collected by the robot have not yet put into the treasure box will disappear. Therefore, the points awarded for those treasures collected will be deducted. The points gained for the treasures already deposited in the treasure box (Section 3.7) will not be affected.

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

1.8 Treasure Box

1.8.1 A treasure box as shown in figure 4, is used to store the treasures collected. The virtual/real robot needs to send the treasures to the designated treasure box after collecting a maximum of 5 treasures.

A virtual/real robot is considered to be in the treasure box if both colour sensors have detected the treasure box.

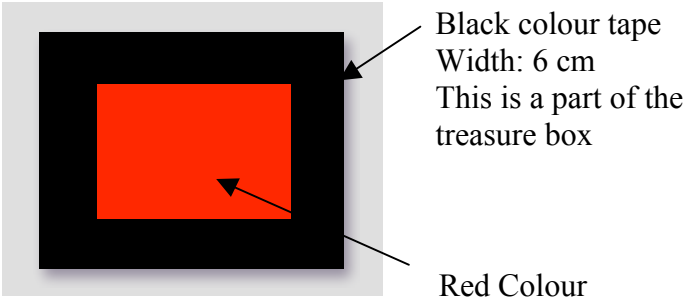

Figure 4: Treasure Box

1.9 Treasures

1.9.1 Treasures will be located in random positions throughout the course. There will be two types of treasures - Red Treasures and Black Treasures. The size of the Black Treasure is smaller than the Red Treasure.

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 Every effort will be made by the organizers to locate the real arena away from magnetic fields such as underfloor wiring and metallic objects. However, sometimes this cannot be avoided.

1.10.3 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 build and 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.

Hint: It is recommended that teams design their robots 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 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

2.2 Construction of Real Robot

Any robot kit or building blocks, either available on the market or built from raw hardware, may be used to build the real robot, as long as the robot fits the above specifications and as long as the design and construction are primarily and substantially the original work of the students (see section 2.5).

The organizer will also provide a standard platform for teams to participate the CoSpace Rescue Challenge if they do not have their own real robots.

2.3 Team

2.3.1 In each round, robots deployed must perform its tasks autonomously.

2.4 Inspection

2.4.1 The robots will be examined by a panel of referees before the start of the tournament and at other times during the competition to ensure that they meet the constraints described above.

2.4.2 It is the responsibility of teams to write their own competition strategies for both virtual and real robots for CoSpace Rescue Challenge

2.4.3 It is the responsibility of teams to have their robots re-inspected if their robots are modified at any time during the tournament.

2.4.4 Students will be asked to explain the operation of their robot and programming in order to verify that the construction and programming of the robot are their own work.

2.4.5 Students will be asked questions about their preparation efforts, and may be requested to answer surveys and participate in video-taped interviews for research purposes.

2.5 Violations*

2.5.1 Any violations of the inspection rules will prevent that robot competing until modifications are effected.

2.5.2 However, modifications must be made within the time schedule of the tournament and teams must not delay tournament play while making modifications.

2.5.3 If a robot fails to meet all specifications (even with modification), it will be disqualified from that round (but not from the tournament).

2.5.4 If there is excessive mentor assistance or the work on the robots is not substantially original work by the students, then the team will be disqualified from the tournament.

* Note: If the standard platform provided by organizer is used, the rule 2.5 is not applicable.

3. GAME PLAY

3.1 Pre-setup

3.1.1 Both real and virtual competition arenas will be released in advance.

3.2 Pre-round Practice

3.2.1 Wherever possible, competitors will have access to practice fields for calibration, testing and tuning throughout the competition.

3.2.2 It will be at the organisers discretion if testing is allowed on the competition fields.

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 told to do so 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 The game consists of two halves. The duration of each half is 6-minutes. There will be a 6-minutes break in between the halves. The game clock will run for the duration of the halves without stopping (except in the case whereby the game coordinator or referee wants to consult an official). The game clock will be started by the game referee or an assistant.

3.4.2 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 (Team will be given 100 points 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 be declared as the winner.

3.5 Pre-match Meeting

3.5.1 Each team will be assigned a lucky 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 lucky colour for their team.

3.6 Start of Play

3.6.1 Virtual competition

Teams should give the treasure hunt strategies (program) to the game coordinator before each half of the virtual game. Teams are not allowed to change the program throughout the virtual competition period. Teams can modify the searching strategies during the break. The game coordinator will then upload the strategies in the competition server, place the team's robot in the starting point and start the competition.

3.6.2 Real competition

During the real competition, teams may do as much calibration as they wish, but must keep in mind that the clock will continue to count down. 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.

Once teams are ready to continue the competition, they must notify the referee. The robot is placed on the starting point as indicated by the referee.

3.6.3 The treasure will be removed from the virtual/real treacherous terrain (competition arena) once it is found by the virtual/real robot.

3.7 Scoring

3.7.1 The main objective of the real/virtual robot is to find the treasures.

3.7.2 Team will be given 100 points at the beginning of the game.

3.7.3 Teams are rewarded 10 points for locating a Red Treasure and 20 points for the Black Treasure in the arena other than the special zone.

3.7.4 Teams are rewarded 20 points for locating each Red Treasure and 40 points for the Black Treasure in the special zone in the arena.

3.7.5 If the virtual/real robot falls into the trap, all treasures collected by the robot have not yet put into the treasure box will disappear. Therefore, the points awarded for those treasures collected will be deducted. The points gained for the treasures already deposited in the treasure box will not be affected.

For example, the robot has collected 3 treasures and gained 30 points. Afterwards, if it stepped into a trap accidentally, the 3 treasures will disappear and 30 points will be deducted. If the robot has already collected and deposited 2 – 10 treasures (refer to

section 3.7.7) in the treasure box and received 100 points. Then the 100 points will not be deducted.

3.7.6 A real/virtual robot must indicate that it has found a treasure by stopping and flashing a lamp for 2 seconds for the Red Treasure or Black Treasure.

3.7.7 The robot must send the treasures to the designated treasure box after collecting a maximum of 2 – 10 (the exact number will be informed 2 hours before the competition). The score will be doubled upon successful placement of the treasure. Otherwise, there will not be allowed to proceed with the further collection of treasures.

3.7.8 Real/virtual robots are penalized 10 points for each lack of progress (see section 3.9).

3.7.9 Ties in scoring will be resolved on the basis of the time taken by each real/virtual robot to complete the course.

3.7.10 The total score will be the summation of the scores for virtual treasure hunt and real treasure hunt.

3.8 Human interference

3.8.1 Except for the lack of progress, human interference (e.g. re-locate the real/virtual robot to any reset points) during the game is not allowed unless permitted by game referee. Violators 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 if there is no progress in the game play for 10 seconds and the situation is not likely to change. Typical lack of progress situations are when the 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.

3.9.2 A team may decide to stop the 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.

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 points.

3.10.2 If two virtual/real robots bump into each other, both robots will be placed at the starting points. 10 points 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 stop the game if all treasures 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 which 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 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 Rescue Technical Committee.

4.3 Special circumstances

4.3.1 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 documenting the design, construction and programming of their robot.

5.1.2 Presentations and/or posters are to be shown to the judges during the scheduled interview session before being put up for viewing by the judges, other teams and the visiting members of the public.

5.1.3 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;
- Pictures of the robot under development;
- Information about the robot, including schematics, mechanical drawings and samples of code;
- Any interesting or unusual features of the robot;
- What the team hopes to achieve in robotics.

5.1.4 Judges will review the presentation and discuss the contents with team members.

5.1.5 Competitors are requested to provide a digital version of their presentation and poster.

5.1.6 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 Sufficient seating will be supplied for mentors to remain in a supervisory capacity close to the student work area.

6.3.3 Mentors are not to repair robots or be involved in programming of students' robots.

6.3.4 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!

Appendix: Competition Platform Requirement

1. Real robot

The communication between real robots, virtual robots, and virtual environment is shown in Fig. 1.

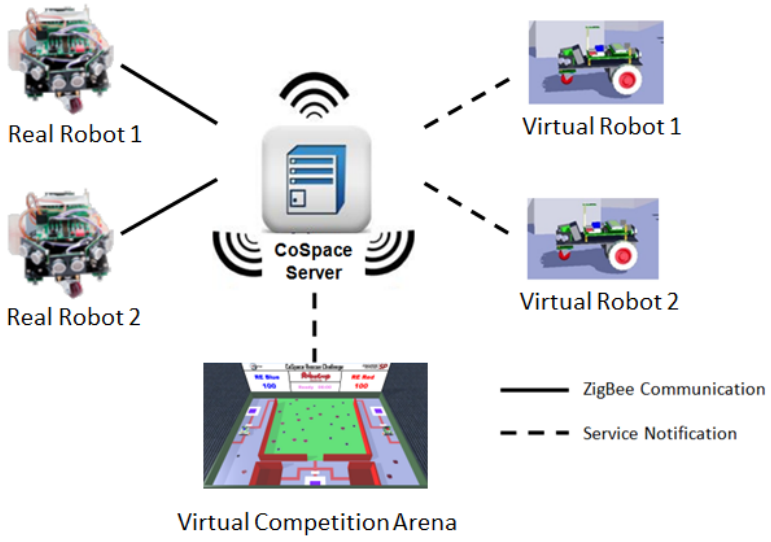

Fig. 1: Communication

In order to communicate with the virtual objects, including virtual robots, in the virtual environment, the real robot must be equipped with a controller board which supports serial communication.

- If you wish to design your own robot with your own controller board, please make sure that the real robot must be equipped with a controller board which supports serial communication. Teams can follow the communication protocol provided to setup the communication. It will be released to teams together with the CoSpace challenge platform.
- Advanced Robotics and Control Centre (ARICC) provides two types of controller board for teams. They are able to support various sensors and motors as well as Lego products. If teams wish to use the controller board developed by the ARICC, please refer to http://www.robocupsingapore.org/cospace/rescue-challenge/system-requirement/76-controller-board for details.
- To help RCJ participants without real robots to participate in the CoSpace Rescue Challenge, the Artificial Robotics and Intelligent Control Centre (ARICC) will provide limited sets of Tribots as in Fig.2 on site for teams to participate in the CoSpace Rescue (Demo) Challenge.

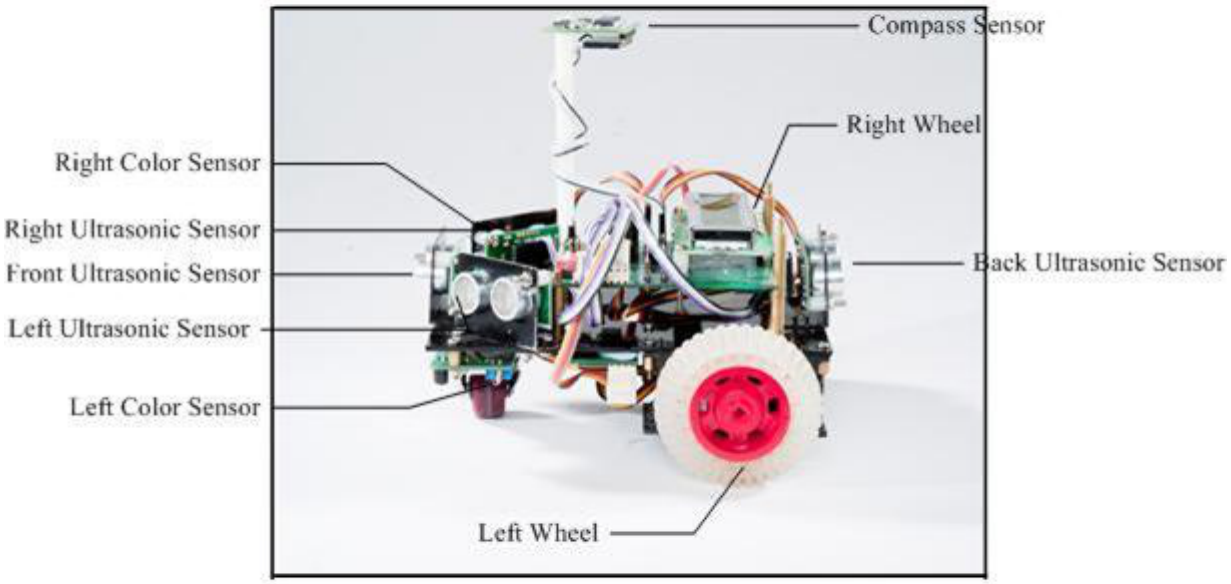

Fig. 2: Tribot

2. Computer System

- CPU: Intel 2.0 GHz and above
- Memory: 2GB DDR3 RAM
- Graphics Card: Support for DirectX 9 graphics with 512MB of graphics memory (non-integrated with motherboard)
- Operating System: Window 7

The CoSpace Rescue Challenge platform RE-VSS-CSR is powered by Microsoft Robotics Developer studio. It operates in the Window environment.