



# **RoboCup Asia-Pacific 2023 Junior Rescue Line Entry Rules - Final**

2023-09-14

RCAP RCJ Rescue Committee



## Mission

This is a mission in which a robot rescues victims in a dangerous area where rescuers cannot approach. The robot must perform its mission on its own without external manipulation or any assistance. The robot must pass through the gate safely, enter and exit only through designated rooms, and move along a safe path. They must also have the ability to avoid obstacles in their path. Finally, the robot must carry out the task of finding the victim and evacuating them to the evacuation zone.

## 1 Field

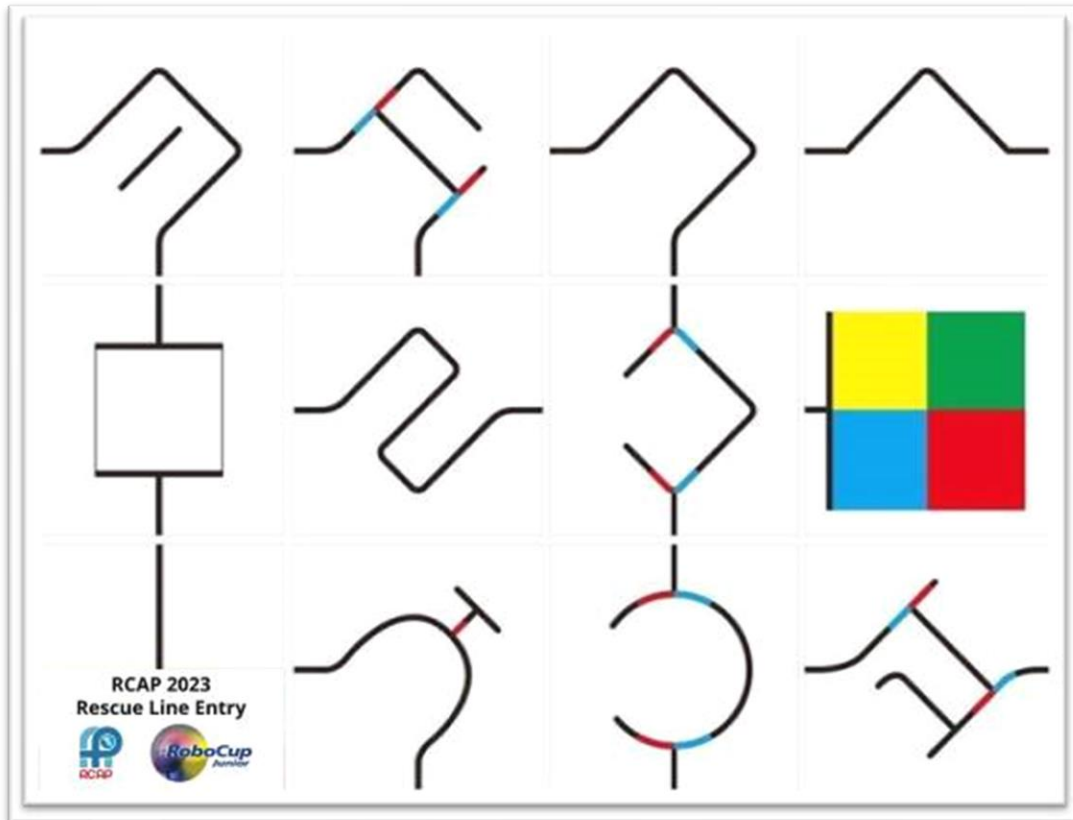
### 1.1 Description

- 1.1.1 The field consists of several tiles which are arranged in different combinations. Each tile is defined as one unit room in a field, and rooms (tiles) are placed next to each other.
- 1.1.2 Each room is 60 cm wide and 60 cm long.
- 1.1.3 The room size tolerance is  $\pm 1.5$  cm.
- 1.1.4 Except for the first room in the field, they are arranged in a random order.
- 1.1.5 The arrangement of rooms may be changed for each match.
- 1.1.6 The pictures presented in the rules are only examples to help understanding, and the field in the actual game may be configured differently from the pictures.

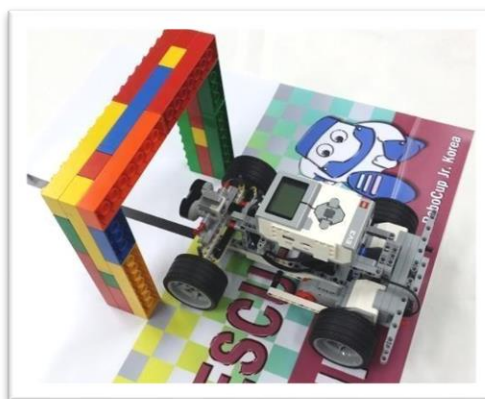
### 1.2 Floor and Line

- 1.2.1 The room is white (or close to white).
- 1.2.2 The playing field will be installed in a place that is as level as possible.
- 1.2.3 The floor of each room is square with black lines (red lines, blue lines, etc.) for the robot to follow. The width of the black line is 1 ~ 2cm, and it can be printed on black insulating tape or other materials and attached to the tile. The black line indicates the path the robot can move along safely.
- 1.2.4 Intersections have black lines, blue lines, and red lines. The red line means a blocked path, and the blue line means the path the robot must continue. Therefore, the robot must continue to move along the blue line or black line path at intersections.
- 1.2.5 Contamination or errors may occur on the field during the production of the tile,

and the organizers will attempt to minimize any significant impacts on the progress of the game.



*Example of Some Possible Tiles*



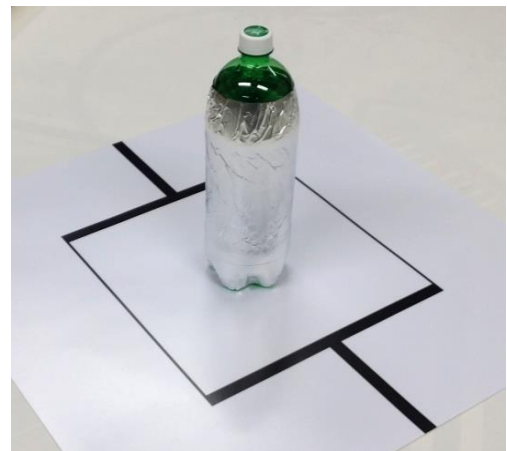
*Example of a Gate*

### 1.3 Gate

- 1.3.1 The first room has a gate. The gate is made up of three pieces (e.g. in the form of a square pillar), two on a pillar and one on top of a pillar.
- 1.3.2 The gate has a height and width of  $19 \pm 1.0$  cm.
- 1.3.3 The robot has to pass through the gate without any interference at the start of the game.
- 1.3.4 If the gate does not maintain its original shape due to contact with the pillar when the robot passes through the gate, it must restart again from the starting position, and the challenge time continues running.

## 1.4 Obstacles

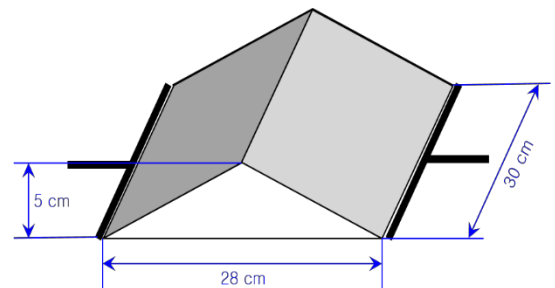
- 1.4.1 The obstacle is a large and heavy object (e.g., brick, bottle, etc.)
- 1.4.2 The robot should avoid the obstacles to get past the room.
- 1.4.3 Obstacles can be moved by the robot, but they must not fall over or go out of the room. If the obstacle is not in the original room at the end of the game, no points are awarded for that room.



*Example Obstacle*

## 1.5 Hill

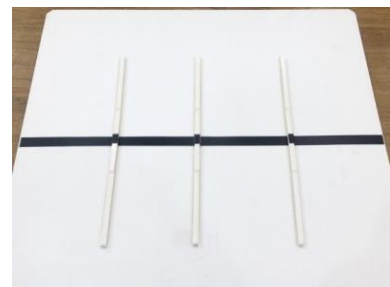
- 1.5.1 Hills are installed on tiles of the same pattern as obstacles, and their sizes are shown in the diagram. (Dimensions: Approx. 28 x30 x 5 cm)
- 1.5.2 The surface of the hill is white, and if the robot drives off the hill, it does not score points for that room.



*Example Hill*

## 1.6 Speed Bump

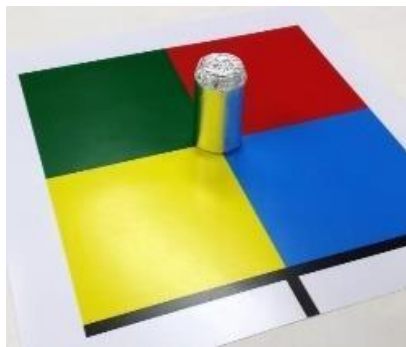
- 1.6.1 Speed bumps are white, fixed to the floor, and have a maximum height of 1 cm.
- 1.6.2 The number and spacing of speed bumps are variable.



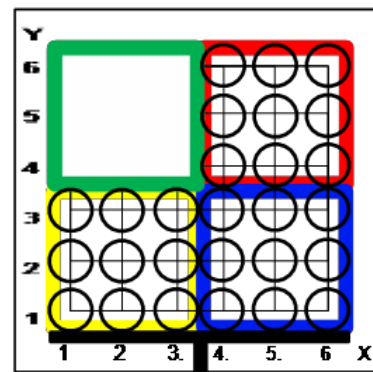
*Example Speed Bumps*

## 1.7 Victim and Evacuation Zone

- 1.7.1 In the last room there is a victim.
- 1.7.2 The victim is in the shape of a cylinder or brick.
- 1.7.3 The location of the victim is placed anywhere in the red, blue and yellow zones, and the location of the victim is changed every game by determining the coordinates with dice by the team captain.
- 1.7.4 The evacuation zone is the green zone, and the mission is recognized as completed when the robot stops while the upright victim is in the evacuation zone.



*Victim & Evacuation Zone*



*Victim Placement Coordinates*

## 1.8 Random Mission

- 1.8.1 There is a random mission between the starting point and the rescue of the victim.
- 1.8.2 Random mission is decided after discussions between the Technical Committee and judges on the day of the competition.
- 1.8.3 It is played only in the last match and the score is equivalent to 10 points.

## 1.9 Environment Conditions

- 1.9.1 The environmental conditions at a tournament may differ from those at home. Teams must come prepared to adjust their robots to the conditions at the venue.
- 1.9.2 Lighting and magnetic conditions may vary in the field.
- 1.9.3 The field may be affected by magnetic fields (e.g., under-floor wiring and metallic objects). Teams should prepare their robots to handle such interference.
- 1.9.4 The field may be affected by unexpected lighting interference (e.g., camera flash from spectators). Teams should prepare their robots to handle such interference.

## 2 Robots



## 2.1 Control

- 2.1.1 Robots must be controlled autonomously. Using a remote control, manual control, or passing information (by external sensors, cables, wirelessly, etc.) to the robot is not allowed.
- 2.1.2 Robots must be started manually by the team captain.
- 2.1.3 Any pre-mapped type of dead reckoning (movements preprogrammed based on known locations or placement of features in the field) is prohibited.
- 2.1.4 Robots must not damage any part of the field in any way.

## 2.2 Construction

- 2.2.1 Robots can be used as commercial products or semi-finished products. Parts made by team members are also available.
- 2.2.2 Robots cannot use any robot or sensor parts manufactured for the purpose of rescue or line tracing for commercial use. The use of pre-programmed sensors or robots for line tracing or obstacle detection is not permitted. If there is a doubtful robot among the participating teams, the decision is requested to the RCAP RCJ Technical Committee.
- 2.2.3 For the safety of players and spectators, the use of lasers on robots is prohibited.
- 2.2.4 Wireless communication is not permitted and must be removed or rendered inoperative and demonstrated inoperability. If an unacceptable wireless communication component is used and robot instructed to remove it, if team do not agree to this, the team will be disqualified immediately.

## 2.3 Inspection

- 2.3.1 A panel of referees will scrutinize the robots before the start of the tournament and at other times during the competition to ensure that they meet the constraints described in these rules.
- 2.3.2 Using a robot similar to another team's robot from a previous year or the current year is illegal.
- 2.3.3 The team's responsibility is to have their robot re-inspected if modified at any time during the tournament.
- 2.3.4 Students will be asked to explain their robot's operation to verify that its construction and programming are their own work.
- 2.3.5 Students will be asked about their preparation efforts. The RCAP RCJ Rescue Committee may request them to answer surveys and participate in videotaped



interviews for research purposes.

- 2.3.6 All teams must complete a web form before the competition to allow referees to prepare better for the interviews. The RCAP RCJ Technical Committee will provide instructions on submitting the form to the teams before the competition.
- 2.3.7 All teams must submit their source code before the competition. The organizers will not share the source code with other teams without the team's permission.
- 2.3.8 All teams must submit their engineering journal before the competition. The organizers will not share the journals with other teams without the team's permission. The organizers will request permission at the registration.

## 2.4 Violations

- 2.4.1 Any violations of the inspection rules will prevent the offending robot from competing until modifications are made, and the robot passes inspection.
- 2.4.2 Teams must make modifications within the schedule of the tournament, and teams cannot delay tournament play while making modifications.
- 2.4.3 Suppose a robot fails to meet all specifications (even with modifications). In that case, it will be disqualified from that game (but not from the tournament).
- 2.4.4 No mentor assistance is allowed during the competition.
- 2.4.5 Any rule violations may be penalized by disqualification from the tournament or the game or result in a loss of points at the discretion of the referees, officials, or RCAP RCJ Rescue Committee.



## 3 Play

### 3.1 Team

- 3.1.1 Each team consists of team members and mentors. Team members are a minimum of 2 and a maximum of 4.
- 3.1.2 Only one robot with one controller is allowed in the competition.
- 3.1.3 Mentors and parents may not be present with team members during the competition. The team members must take care of everything themselves.

### 3.2 Participants

- 3.2.1 One of the participants is designated as the captain, and during the game, the captain always handles the robot under the supervision of the referee and according to the game rules.
- 3.2.2 The captain may only move the robot with the referee's permission.
- 3.2.3 Other team members must stay at least 100 cm away from the field during the game.
- 3.2.4 No one may touch the field of play during the game.

### 3.3 Start of Game

- 3.3.1 The start time of the match is respected regardless of whether the teams are ready to play or not. The start time will be posted in a conspicuous place within the competition area.
- 3.3.2 Once the game starts, robots cannot leave the field under any circumstances.
- 3.3.3 Maximum of 3 minutes per match, including robot calibration. This time is measured by the referee.
- 3.3.4 Teams that are ready to start the game must inform the referee. The game starts at the referee's signal, and the robots are started from the starting position of the first room by the team captain.

### 3.4 Scoring

- 3.4.1 10 points are awarded for each room if the robot successfully passes each room (not including the evacuation zone).
- 3.4.2 Successful passage' means that the robot passes through the entrance of the corresponding room without human intervention and moves to the outside of the corresponding room (next room) by driving along the line without leaving.





- 3.4.3 Out of line means the case where the drive wheels are located on one side of the line instead of both sides, or when one of the drive wheels goes out of the room, which is a dangerous area. Exceptionally, out of line is allowed in rooms with obstacles and hills.
- 3.4.4 In case the robot deviated from the line, the captain of the team can bring the robot to the starting area within the maximum game time and start again, but the same room score will not be counted twice.
- 3.4.5 For the room with the victim, the victim must be moved, and when viewed from above, more than half of the victim must be in the safety area to be considered a rescue. After the rescue, the robot should stop inside the last room. When all of the above conditions are met, the robot rescues the victim and 10 points are given.
- 3.4.6 Timekeeping begins at the same time as the referee's start signal. The time measurement stops when the robot stops after the rescue mission in the last room or when the team captain asks the referee to end the game.
- 3.4.7 In this game, the rescue of the victim takes precedence, and the second priority is the sum of the scores from each game. In the case of the same score, the team with the shorter game time by adding the measured game time takes precedence.

## 3.5 End of Game

- 3.5.1 A team may elect to stop the game early at any time. In this case, the team captain must indicate the team's desire to terminate the game to the referee. The team will be awarded all points earned up to the call for the end of the game. The referee will stop the time at the end of the game, which will be recorded as the game time.
- 3.5.2 The game ends when:
  - i. The 3 minutes of allowed game time expires.
  - ii. The team captain calls the end of the game.
  - iii. The robot reaches the goal tile and completely stops for 3 seconds.



## 4 Open Technical Evaluation

### 4.1 Description

- 4.1.1 The organizers will evaluate your technical innovation during a dedicated time frame. All teams need to prepare for an open display during this time frame.
- 4.1.2 Judges will circulate and interact with the teams. The Open Technical Evaluation is intended to be a casual conversation with a question-and-answer atmosphere.
- 4.1.3 The Open Technical Evaluation's main objective is to emphasize innovation's ingenuity. Innovative may mean technical advances compared to existing knowledge or an out-of-the-ordinary, simple but clever solution to existing tasks.

### 4.2 Evaluation Aspects

- 4.2.1 A standardized rubric system will be used, focusing on:
  - Creativity
  - Cleverness
  - Simplicity
  - Functionality
- 4.2.2 Your 'work' can include (but is not limited to) one of the following aspects:
  - Creation of your own sensor instead of a pre-built sensor.
  - Creation of a 'sensor module' which is comprised of various electronics resulting in a self-contained module to provide specific functionality.
  - Creation of a mechanical invention that is functional but out of the ordinary.
  - Creation of a new software algorithm for a solution.
- 4.2.3 Teams must provide documents that explain their work. Each invention must be supported by concise but clear documentation. The documents must show precise steps towards the creation of the invention.
- 4.2.4 Documents must include one poster and one engineering journal. Teams should be prepared to explain their work.
- 4.2.5 Engineering Journals should demonstrate your best practices in the development process.
- 4.2.6 The poster should include but is not limited to: the name of the team, country, league, robot description, robot capabilities, controller, the programming language used, sensors included, method of construction, time used for development, cost of materials, and awards won by the team in its country, etc.



## 4.3 Sharing

- 4.3.1 Teams are encouraged to review others' posters and presentations.
- 4.3.2 Teams awarded certificates must post their documents and presentation online at the RCAP RCJ Rescue Committee's request.

## 5 Conflict Resolution

### 5.1 Referee and Referee Assistant

- 5.1.1 All decisions during gameplay are made by the referee or the referee assistant, who are in charge of the field, persons, and objects surrounding them.
- 5.1.2 During gameplay, the decisions made by the referee, or the referee assistant are final.
- 5.1.3 After game play, the referee will ask the captain to sign the score sheet. Captains will be given a maximum of 1 minute to review the score sheet and sign it. By signing the score sheet, the captain accepts the final score on behalf of the entire team. In case of further clarification, the team captain should write their comments on the score sheet and sign it.

### 5.2 Rule Clarification

- 5.2.1 If any rule clarification is needed, please contact the RCAP RCJ Rescue Committee.
- 5.2.2 If necessary, even during a tournament, a rule clarification may be made by members of the RCAP RCJ Rescue Committee.

### 5.3 Special Circumstance

- 5.3.1 If particular circumstances, such as unforeseen problems or capabilities of a robot occur, rules may be modified by the RCAP RCJ Rescue Committee Chair in conjunction with available committee members, even during a tournament.
- 5.3.2 Suppose team captains do not attend the team meetings to discuss problems, and the resulting rule modifications described in 5.3.1. In that case, the organizers will understand that they were aware of and have agreed to the changes.

The RCAP RCJ Rescue Organising Committee would like to acknowledge the RoboCup Korea Association (NPO) for drafting the Junior Rescue Line Entry rules.



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