RoboCupJunior Rescue Simulation (Demonstration) - Rules 2020

The RoboCupJunior Rescue Simulation (Demonstration) rules are developed by the Working Group members composed of both Junior members and Major Rescue Simulation members. The rules are reviewed and confirmed by the RoboCupJunior Rescue Technical Committee 2020.

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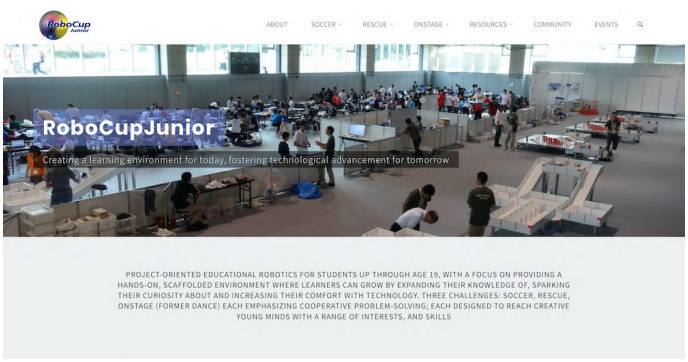
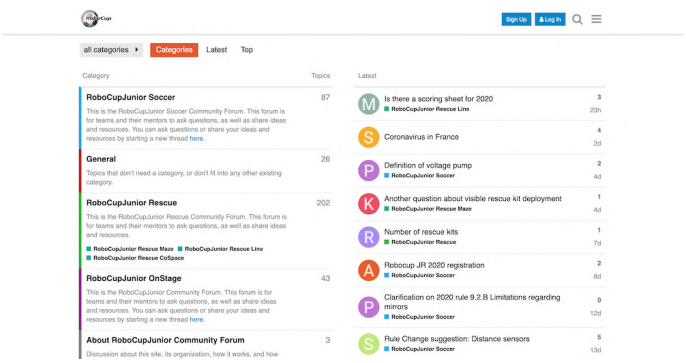
Official Resources

RoboCupJunior Official Site	RoboCupJunior Official Forum
 https://junior.robocup.org/	 https://junior.forum.robocup.org/

Corrections and clarifications to the rules may be posted on the Forum in advance of updating this rule file. It is the responsibility of the teams to review the forum to have a complete vision of these rules.

Before you read the rules

Please read through the RoboCupJunior General Rules before proceeding on with these rules, as they are the premise for all rules. The English rules published by the RoboCupJunior Rescue Technical Committee are the only official rules for RoboCupJunior Rescue Simulation (Demonstration) 2020. The translated versions that can be published by each regional committee are only reference information for non-English speakers to better understand the rules. It is the responsibility of the teams to have read and understood the official rules.

The "robot" refers "virtual robot" in these rules.

Scenario

For navigation of hard to dangerous or hard to access environments, robots can be used for search and rescue operations to minimize the risk to humans. In this challenge the autonomous controller for a robot must be developed to search and identify victims in a simulated hazardous rescue scenario. The robot must navigate through challenging terrains without getting stuck, must search for victims and signal the victims' locations of human search teams.

The robot will be pitted against each other to find the most victims in 8 minutes.

Summary

The robot needs to search through a maze for victims. The robot should not find the fastest path through the maze, instead it should explore as much of the maze as possible. The robot will be awarded 15 or 30 points for each victim detected.

If the robot is stuck in the maze it can be restarted at the last visited checkpoint. Silver tiles in the field represent checkpoints so the robot can save the position to a map (if it uses a map) in a non-volatile medium and restore it in case of a restart.

Contents

1. Code of Conduct

1.1. Spirit

1. It is expected that all participants (students and mentors alike) respect the aims and ideals of RoboCupJunior as set out in our mission statement.
2. The volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and, most importantly, fun.
3. **It is not whether you win or lose, but how much you learn that counts!**

1.2. Fair Play

1. Robots that cause deliberate or repeated damage to the field will be disqualified.
2. Humans that cause deliberate interference with the Rescue Simulation runs including simulation engine, server, and/or computers, etc will be disqualified.
3. It is expected that the aim of all teams is to participate fairly.

1.3. Behavior

1. Each team is responsible for verifying the latest version of the rules on the RoboCupJunior Official website prior to the competition.
2. Participants should be mindful of other people and their robots when moving around the tournament venue.
3. Participants are not allowed to enter setup areas of other leagues or other teams, unless explicitly invited to do so by team members.
4. Teams will be responsible for checking updated information (schedules, meetings, announcements, etc.) during the event. Updated information will be provided on notice boards in the venue and (if possible) on the local competition website and/or the RoboCup or RoboCupJunior websites.
5. Participants who misbehave may be asked to leave the venue and risk being disqualified from the tournament.
6. These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.
7. Teams are expected to be present at the venue early on the setup day as important activities will occur. These activities include, but are not limited to: registration, participation raffle, interviews, captains and mentor’s meetings.

1.4. Mentors

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

2. Mentors are not permitted to be directly involved in the programming before and during the competition.
3. Mentor interference with robots or referee decisions will result in a warning in the first instance. If this behavior recurs, the team could face a possible elimination from the tournament.
4. Robots have to be mainly student's own work. Any robot that appears to be identical to another robot may be prompted for re-inspection.

1.5. Ethics and Integrity

1. Fraud and misconduct are not condoned. Fraudulent acts may include the following:
    a. Mentors working on the software or hardware of student's robot(s) during the competition.
    b. More experienced/advanced groups of students may provide advice but should not do the work for other groups. Otherwise, the team risks being disqualified.
2. RoboCupJunior reserves the right to revoke an award if fraudulent behavior can be proven after the award ceremony takes place.
3. If it is evident that a mentor intentionally violates the code of conduct, and repeatedly modifies and works on the student's robot(s) during the competition, the mentor will be banned from future participation in RoboCupJunior competitions.
4. Teams that violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify a single team member from further participation in the tournament.
5. In less severe cases of violations of the code of conduct, a team will be given a warning. In severe or repeated cases of violations of the code of conduct, a team can be disqualified immediately without warning.

1.6. Sharing

1. The spirit of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the tournament.
2. Any developments may be published on the RoboCupJunior website after the event.
3. Participants are strongly encouraged to ask questions to their fellow competitors to foster a culture of curiosity and exploration in the fields of science and technology.
4. This furthers the mission of RoboCupJunior as an educational initiative.

2. Field

2.1. Simulation platforms

1. We will be running games on a platform called Webots.
2. For setup guide: Platform wiki page

3. Teams are required to create programs to solve maze tasks.
4. The organizers will run the games on a server-client model, and will prepare one RJ-45 socket for teams to connect to the game server. Teams must prepare a computer and an ethernet cable to run the prepared programs. (This will not apply to the virtual demo competition in September.)
5. Teams are encouraged to develop their own worlds, and upload these to the Forum to encourage sharing.

2.2. Description

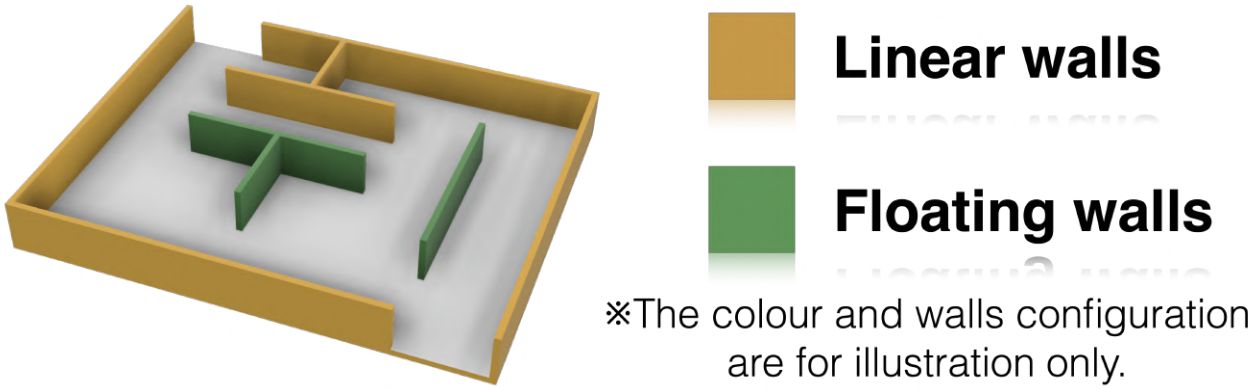
1. The field layout will consist of a collection of tiles with a horizontal floor, a perimeter wall, and walls within the field.
2. All walls used to create the maze are mounted on the edges of the tiles.
3. Refer to the platform document in Section 2.1, “Simulation platforms” regarding tiles/walls dimension.

2.3. Checkpoints

1. Silver tiles in the field represent checkpoints.
2. Silver tiles will be placed randomly at the start of each game.

2.4. Path

1. Walls may or may not lead to the entrance/exit. Walls that lead to the entrance/exit are called "linear walls". The walls that do NOT lead to the entrance/exit are called "floating walls".
2. Pathways for the robot are intended to be of the width of the tile, and may open into foyers wider than the pathways.
3. One of the outermost tiles is the starting tile, where a robot should start the run.

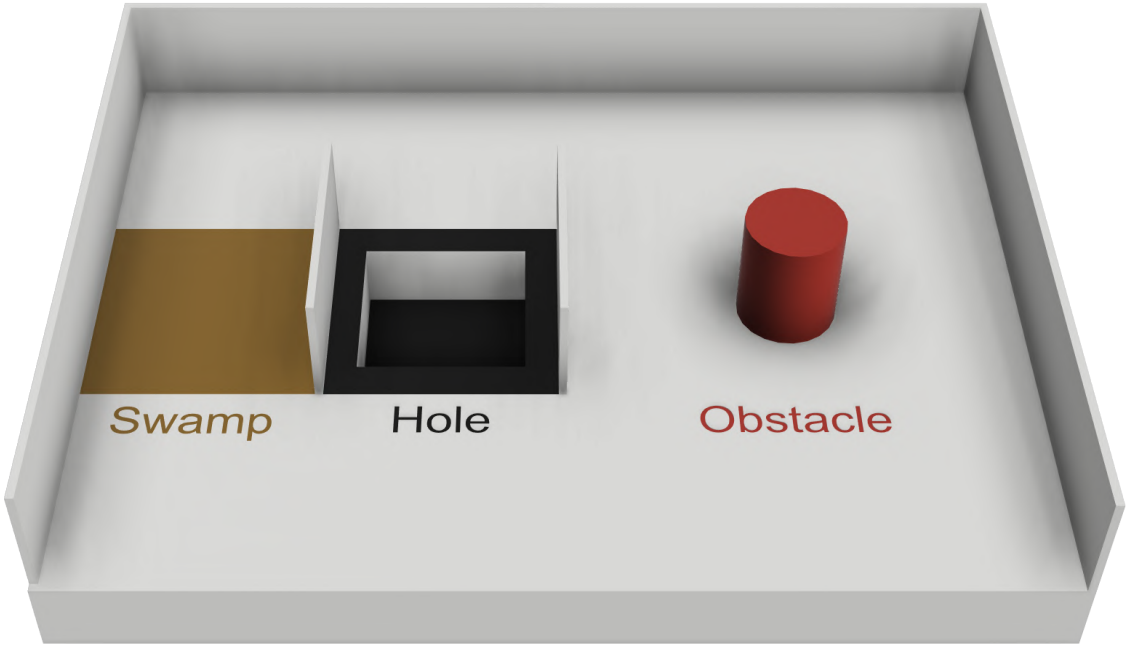


2.5. Swamps, Obstacles and Holes

1. Swamps:
    a. The colour is brown.

   b. This affects the straight-driveability and speed of the robot.

2. Obstacles:
   a. May consist of any large and heavy items.
   b. May be fixed to the floor.
   c. May be any shape including rectangular, pyramidal, spherical or cylindrical.
   d. The colour of the obstacle is not specified.
3. Holes :
   a. The edge of the holes are coloured black.
   b. The robot has to avoid the hole.
4. Refer to the platform document in Section 2.1, “Simulation platforms” for detailed specification.



2.6. Victims

1. There are two types of victims: heated victims, visual victims.
2. Victims are located anywhere on the walls.
3. The temperature of the heated victim simulates human body temperature between 35°C to 40°C.
4. Visual victims are uppercase letters printed on or attached to the wall. They are printed in black, using a sans serif typeface such as “Arial”. The letters represent the health status of the victim.
   a. Harmed victim: H
   b. Stable victim: S
   c. Unharmed victim: U

5. Refer to the platform document in Section 2.1, “Simulation platforms” for detailed dimension/measurement.

3. Robots

3.1. Construction

1. The robot model used on each platform is provided by the organizers.
2. The teams are not allowed to create and use their own robot model.
3. The teams are not allowed to modify the provided robot model.

3.2. Sensors

1. The robot has the following sensors.
    a. Location sensor to detect where the robot is in the field
    b. Light sensor to detect floor colour
    c. Distance sensor to measure distance to surrounding walls
    d. RGB camera to search victims
    e. Thermal camera to search victims
2. The simulation world and robot will have been created with noise which is similar to real world noise levels. Teams should ensure their programs are robust to this noise. The noise levels within the simulation will not be changed for the competition.
3. The number of sensors installed and the simulated performance varies for each platform.

3.3. Control

1. Robots 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.
2. Robots will be started by the referee.
3. Robots may utilize various maze navigation algorithms. Any pre-mapped type of dead reckoning (movements predefined based on known locations or placement of features in the field) is prohibited.

3.4. Team

1. Each team must have only one robot in the field.
2. Each team must have between 2 and 4 members.
3. A student can be registered on only one team across all RoboCupJunior leagues/sub-leagues.
4. A team is only allowed to participate in one league/sub-league in across all RoboCupJunior leagues/sub-leagues.
5. Each team member will need to explain their work and should have a specific technical role.
6. All team members must be the correct age as stated on the RoboCupJunior General Rules.
7. Mentors/parents are not allowed to be with the students during the competition. The students will have to self-govern themselves (without mentor's supervision or assistance) during the long stretch of hours at the competition.

3.5. Inspection

1. Students will be asked to explain the operation of their programs in order to verify that all are their own works.
2. Students will be asked about their preparation efforts and may be requested to answer surveys and participate in video-taped interviews for research purposes.
3. All teams must complete a web form prior to the competition to allow referees to better prepare for the interviews. Instructions on how to submit the form will be provided to the teams prior to the competition.
4. All teams have to submit their source code prior to the competition. The source code will not be shared with other teams without the team's permission.
5. All teams must submit their engineering journal prior to the competition. The journals will not be shared with other teams without the team's permission.

However, it is highly recommended that teams publicly share their engineering journal. With the teams that indicate that their engineering journals could be shared publicly during the registration process, the journal alongside their poster presentation will be shared through the RoboCupJunior Forum so that other teams could learn from them.

3.6. Violations

1. Modifications must be made within the time schedule of the tournament and teams cannot delay tournament play while making modifications.
2. No mentor assistance is allowed during the competition. (See Section 1, "Code of Conduct")
3. Any violations of the rules may be penalized by disqualification from the tournament or the round or may result in a loss of points at the discretion of the referees, officials, organizing committee or general chairs.

4. Play

4.1. Pre-round Practice

1. When possible, teams will have access to practice simulation environments for calibration and testing throughout the competition.
2. Whenever there are dedicated independent simulation environments for competition and practice, it is at the organizers' discretion if testing is allowed on the competition environments.

4.2. Humans

1. Teams should designate one of their members as "captain" and another one as "co-captain." Only these two team members will be allowed access to the competition areas where the simulation environments are located, unless otherwise directed by a referee.
2. All operations of the simulation environment in game, such as loading programs and operating LoP, are performed by the referee.
3. No one is allowed to touch the simulation environments intentionally during a game.

4.3. Before the game

1. When the beginning of a round is called, teams must submit their computer with the program to run saved on it. The method to collect the computers will be announced by the organisers.
2. The time limit of submitting the computer with the program to be run in each game will be decided by the organizers.
3. If the computer is not submitted by the time limit, the team is considered to have abandoned the game. The score of the game will be -50 points.
4. Competition World for each round will only be revealed after the round's computers submission time expires.
5. No changes or updates to the program after the deadline of each rounds are allowed.
6. A game begins at the scheduled starting time whether or not the team is present or ready. Start times will be posted around the venue.
7. Pre-mapping the field and/or victim's location is prohibited. Pre-mapping activities will result in immediate robot disqualification for the round.

4.4. Start the game

1. Before the start of the game, the next team should prepare the computer submitted at the beginning of the round to run the program, as a client to the game server. A maximum of 2 minutes will be given.
2. When ready, run the program and report to the referee. The team is not allowed to touch a client

computer after this in any reasons.

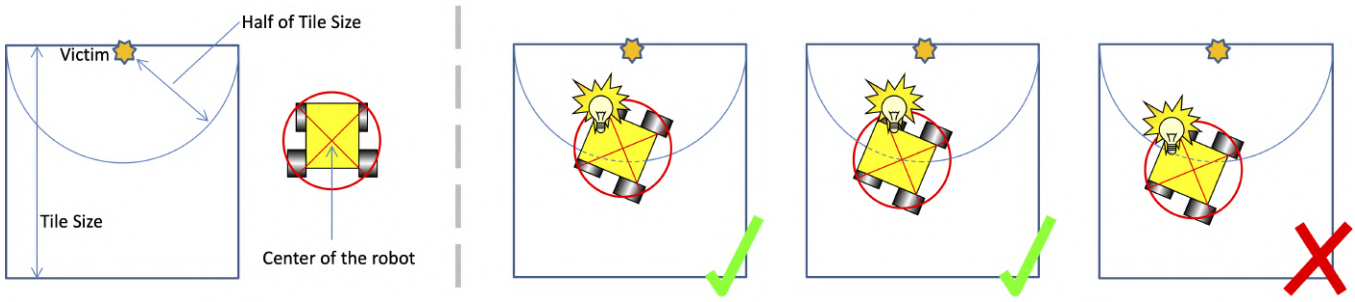
3. The game will start with a referee's operation on game server.
4. Each game lasts a maximum of 8 minutes.
5. Teams are not allowed to give their robot any prior information about the field. A robot is supposed to recognize the field elements by itself.
6. A "visited tile" means that center of the robot is inside. This judgement is made by the game management system.

4.5. Lack of progress

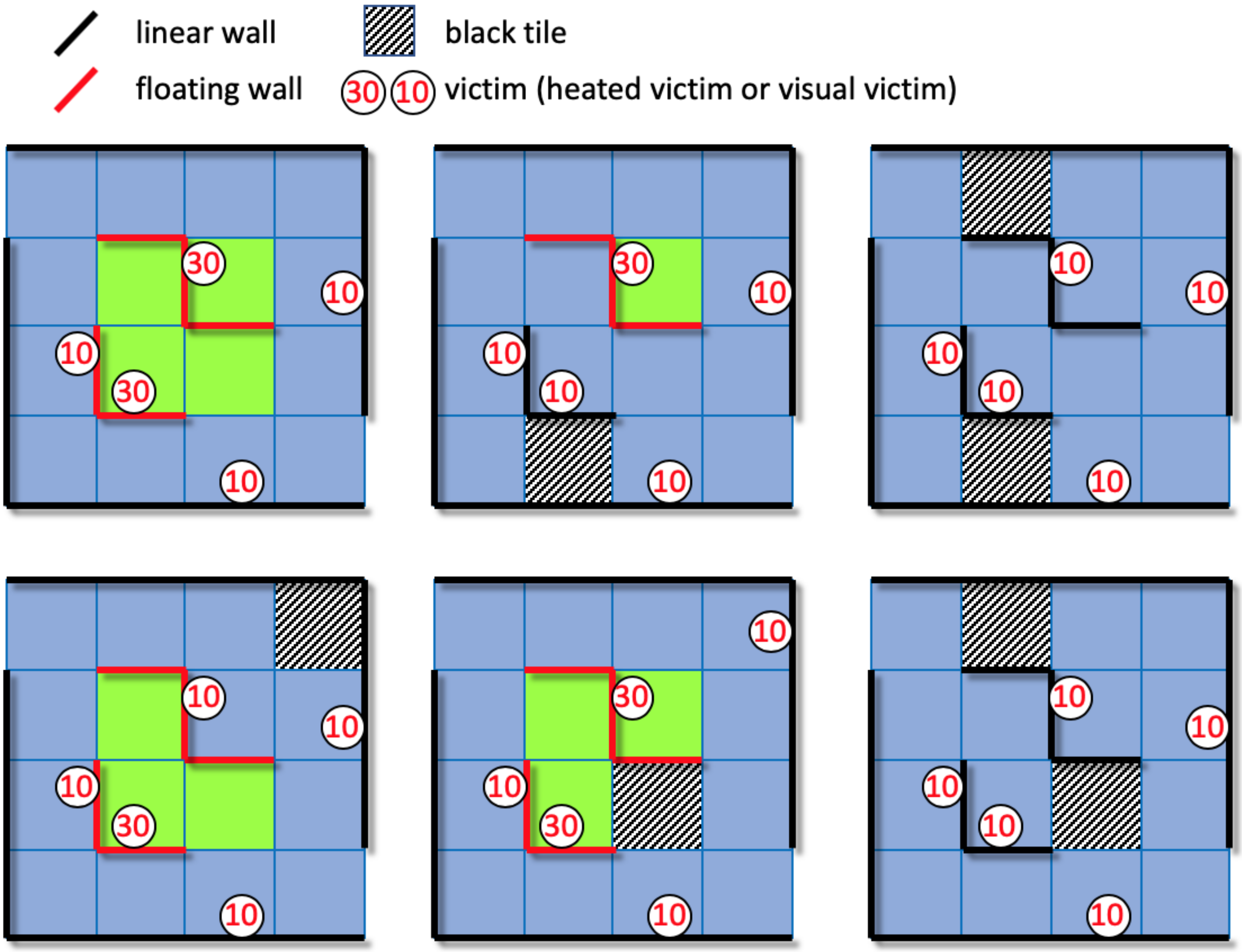
1. A Lack of Progress (LoP) occurs when:
   a. The robot has fallen into a hole.
   b. LoPs will be automated after robot being in a static location for 20 seconds or more.
   c. In any other cases, calling for LOP rests on team captain, but final decision must be made by referee.
2. In the event of a lack of progress, the robot must return to the last visited checkpoint (or the start tile if never reached a checkpoint). The robot can be installed in any direction. For the definition of the visited tile (see 4.4.6).
3. The operation of lack of progress will be done by the referees.

4.6. Scoring

1. To identify a victim, the robot must stop by the victim and blink an indicator light/LED for 3 seconds. After 3 seconds, it must send a command to the game manager with the following information.
   a. Type of the victim (Heated / H / S / U) in a platform specific format. Please refer to the platform document in Section 2.1, "Simulation platforms".
2. For successful victim identification, the center of robot must be equal to or less than half a tile distance from the location of the victim, when the robot indicates a victim has been identified.



3. Points are rewarded for each Successful Victim Identification on the field.
   a. For victims located on a tile adjacent to a linear wall (even diagonally), i.e. all victims at the 6 tiles around a linear wall. : 10 points
   b. On other walls (i.e.: floating walls) : 30 points



Heated and visual victims score

> Some of the victims on the floating wall are worth 10 points. This is because 10 points victims are on a tile near a linear wall. The colour in the figure is for illustration only.

4. Additional 10 points are rewarded if the reported type of the victim is correct.
5. If a robot identifies the location of the victim to be greater than half the tile size away from the true position, it will be considered a misidentification and will cause 5 points deduction. However, the total points will never go below zero points.
6. Successful Checkpoint Negotiation. A robot is awarded 10 points for each visited checkpoint. Refer to 4.4.6 for definition of visited tile.
7. Successful Exit Bonus. A robot will be awarded 10% of total score as an exit bonus if at least one victim has been identified. In addition, there will be an additional 10 points at exit. The “exit bonus” condition is satisfied when the robot returns to the starting tile, sends an "exit" command to the game manager to finish the game.
8. Each LoP will cause 5 points deduction. However, the total points will never go below zero points.
9. Ties at the end. Ties in scoring will be resolved based on the time each robot took to complete the game.

10. No duplicate rewards. For example, if a robot successfully visited a checkpoint multiple times, only one successful checkpoint negotiation will be rewarded. The same result applies to all other scoring rules.
11. Scoring will be automated through the platform scoring engine.

4.7. End of Play

1. A team may elect to stop the round early at any time. 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 earned up to the call for the end of the round.
2. The round ends when:
   a. The time expires.
   b. The team captain calls end of round.
   c. The robot sends an "exit" command to the game manager.

5. Open Technical Evaluation

5.1. Description

1. Your technical innovation will be evaluated during a dedicated time frame. All teams need to prepare for an open display during this time frame.
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.
3. The main objective of the Open Technical Evaluation is to emphasize the ingenuity of innovation. Being innovative may mean technical advances as compared to the existing knowledge, or an out-of-the-ordinary, simple but clever, solution to existing tasks.

5.2. Evaluation Aspects

1. A standardized rubric system will be used focusing on:
   - creativity
   - cleverness
   - simplicity
   - functionality
2. Your "work" can include (but is not limited to) one of the following aspects:
   - creation of a new software algorithm to a solution
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. Documents must include one poster and one engineering journal. Teams should be prepared to explain their work.
5. Engineering journals which include development process and best practices must be submitted. More details about the mechanism to be used will be announced at the RoboCupJunior forum.
6. The poster should include name of team, country, league, programming language / libraries used, detail description of the algorithm you developed, time used for development and awards won by the team in its country, etc.

5.3. Sharing

1. Teams are encouraged to review other's posters and presentations.
2. Teams awarded with certificates are required to post their documents and presentation online when asked by the OC/TC.

6. Conflict Resolution

6.1. Referee and Referee Assistant

1. During game play, the decisions made by the referee and/or the referee assistant are final.
2. At conclusion of 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.

6.2. Rule Clarification

1. If any rule clarification is needed, please contact the International RoboCupJunior Rescue Technical Committee.
2. If necessary even during a tournament, a rule clarification may be made by members of the RoboCupJunior Rescue Technical Committee (TC) and Organizing Committee (OC).

6.3. Special Circumstances

1. If special circumstances, such as unforeseen problems or capabilities of a robot occur, rules may be modified by the RoboCupJunior Rescue Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, even during a tournament.
2. If any of the team captains/mentors do not show up to the team meetings to discuss the problems and the resulting rule modifications described at 6.3.1, it will be considered as an agreement.
3. In the event of unexpected issues, the OC will do its utmost to avoid any disadvantage to the team.

Technical Contributors

Thank you to all who have contributed in this great work.

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