# RoboCupJunior Soccer Simulation Rules 2021


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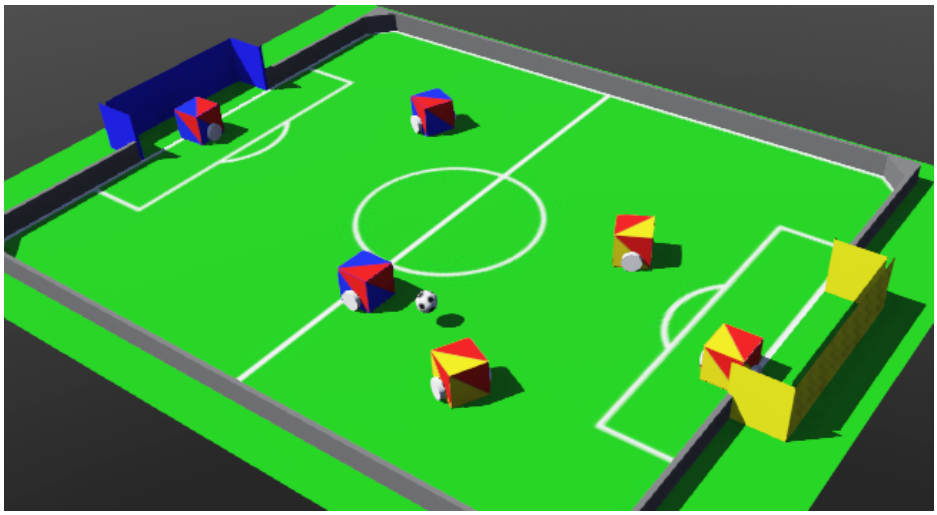
These are the official Soccer Simulation rules for **the RoboCupJunior 2021**. They are released by the RoboCupJunior Soccer Technical Committee (TC). The English version of these rules has priority over any translations.

Teams are advised to check the RoboCupJunior Soccer site https://junior.forum.robocup.org/ for OC (Organizational Committee) procedures and requirements for the international competition. Each team is responsible for verifying the latest version of the rules prior to competition. [1]

Instructions on the Webots environment, on how to program controllers, as well as demos and tutorials can be found online at https://robocupjuniortc.github.io/rcj-soccer-sim/.

**Figure 1** Two teams of three robots in a simulated RoboCupJunior Soccer match.



This is the final version of the rules for the RCJ Soccer Simulation Challenge 2021. This version differs only slightly from the drafts published earlier this year.

[1] The current version of these rules can be found at https://robocupjuniortc.github.io/soccer-rules-simulation/rules.html in HTML form and at https://robocupjuniortc.github.io/soccer-rules-simulation/rules.pdf in PDF form.

# Preface

In the RoboCupJunior Soccer Simulation challenge, teams of young engineers program three fully autonomous digital robots to compete against another team in simulated matches. The robots must detect a ball and score into a color-coded goal on a special field that resembles a human soccer field.

To be successful, participants must demonstrate special programming skills. Teams are also expected to contribute to the advancement of the community as a whole by sharing their discoveries with other participants and by engaging in good sportsmanship, regardless of culture, age or result in the competition. **All are expected to compete, learn, have fun, and grow.**

*The RoboCupJunior Soccer Simulation Challenge is a special addition to the existing RoboCupJunior Soccer Leagues. There is no need to meet in person for the RoboCupJunior Simulation Challenge. It was created primarily for the 2021 season. There is no guarantee for continuing it throughout later seasons. However, depending on the results and feedback from the community, there might be future RoboCupJunior Soccer Simulation challenges and leagues.*

### Programming has to be performed exclusively by the students

Robots must be programmed exclusively by student members of the team. Mentors, teachers, parents or companies should not be involved in the software design, programming or debugging of robots. To avoid embarrassment and possible disqualification, it is extremely important that teams abide by all other competition's rules.

If in doubt, please consult with your Regional Representative before registering your team.

# 1 GAMEPLAY

## 1.1 Game Procedure and Length of a Game

1.1.1 RCJ Soccer games consist of two teams of robots playing soccer against each other. Each team has three autonomous robots. The game will consist of two halves. The duration of each half is 10 minutes.

1.1.2 The game will be timed by an artificial referee program. The referee will make all the decisions during the game automatically, including the placement of the ball and of robots. There will be no discussion on decisions the artificial referee took.

## 1.2 Pre-Match Programming

1.2.1 Teams will send their code to the organization committee (OC) before the competition. The matches will then be conducted by the OC, which will run the code of the teams against each other. The matches will either be pre-recorded, or streamed live via an online streaming service.

## 1.3 Pre-Match Meeting

1.3.1 At the start of the first half of the game, the artificial referee will choose the team kicking off at random, as well as the goal they will kick towards. After the first half, teams switch sides. The team not kicking off in the first half of the game will kick off to begin the second half of the game.

## 1.4 Kick-Off

1.4.1 Each half of the game begins with a kick-off. All robots will be positioned by the artificial referee on their own side of the field and halted. The ball is positioned by the artificial referee in the center of the field. All robots on the team not kicking off will be outside of the center circle.

1.4.2 On the artificial referee's command, all robots will be started immediately.

### 1.4.A Neutral Kick-Off

1.4.A.1 A neutral kick-off is the same as the one described in Rule 1.4, Kick-Off with a small change: all robots must be placed outside of the center circle.

## 1.5 Human Interference

1.5.1 Except for starting or stopping the simulation, human interference during the simulated matches is not permitted, neither by teams nor by the OC. All decisions and actions are taken by the robots' programs and the artificial referee autonomously.

## 1.6 Ball Movement

1.6.1 A robot cannot hold the ball.

## 1.7 Scoring

1.7.1 The artificial referee will consider a goal as being scored as soon as the ball crosses the goal line.

1.7.2 Goals scored either by an attacking or defending robot have the same end result: they give one goal to the team on the opposite side. After a goal, the game will be restarted with a kick-off from the team who was scored against.

## 1.8 Inside the Penalty Area

1.8.1 No robots are supposed to be inside any penalty area for more than 15 seconds. After this time, they will be re-spawned on the furthest unoccupied neutral spot facing sideways. For this rule to apply, a robot must be inside the penalty area with its center of mass.

1.8.2 For the timer to be reset, the robots must be outside the penalty area for more than 2 seconds.

## 1.9 Lack of Progress

1.9.1 Lack of progress occurs if there is no progress in the gameplay for a reasonable period of time. Typical lack of progress situations are when the ball is stuck between robots, when there is no change in ball and robot's positions, or when the ball is beyond detection or reach capability of all robots on the field.

1.9.2 If no significant ball movement occurs for 10 seconds, the artificial referee will call "lack of progress" and will move the ball to **a random unoccupied neutral spot.** If this does not solve the lack of progress, the referee can move the ball to a different neutral spot.

### 1.10 Out of Bounds

1.10.1 There is no ”Out of Bounds” rule.

1.10.2 **If the ball or any robot accidentally leaves the field of play, it will be returned into play immediately, and placed on the field according to the rules of Rule 1.9, Lack of Progress.**

### 1.11 Damaged Robots

1.11.1 Sometimes robots in the simulation will tip or fall over. In any case when a robot does not move for 15 seconds, the artificial referee will re-spawn it onto the nearest unoccupied neutral spot.

1.11.2 A robot that is respawned more than 3 times in a row according to this rule without moving at all in-between is considered damaged and will be taken off the field. The robot must remain off the field for one minute or until the next kick-off is due. It will be placed on the free unoccupied neutral spot furthest from the ball, facing sideways.

### 1.12 Interruption of Game

1.12.1 In principle, a game will not be stopped.

## 2 TEAM

### 2.1 Regulations

2.1.1 A team must have two, three or four members to form a RoboCupJunior team to participate in the International event. A team member(s) and/or program(s) cannot be shared between teams.

2.1.2 Each team must have a **captain**. The captain is the person responsible for communication with the OC. The team captain should be in a position to answer all of the OC’s requests and questions. The team can replace its captain during the competition.

### 2.2 Violations

2.2.1 Teams that do not abide by the rules are not allowed to participate.

## 3 ROBOTS

### 3.1 Number of Robots / Substitution

3.1.1 Each team must have exactly three programs for the full tournament. [2] The substitution of programs during the competition within the team or with other teams is forbidden.

[2] This means, each of the three robot has its own program. This can be three different programs, or three times the same program, or anything in between.

## 3.2 Robot Control

3.2.1 The Teams will write a controller program to move the robots during the simulation. The simulated robots have two wheels to control its movement (one on each side - differential-drive). The only aspect of the simulation that the program is allowed to act on is the speed of the wheels of the robot that it is controlling. The program will be pre-written by the teams and used for the whole competition. Substitution of the program during the competition or during a match is not allowed.

## 3.3 Interference

3.3.1 Teams are not allowed to interfere with the simulation in any unofficial way. Teams may be penalized or disqualified by the OC for any attempt to influence or work-around the artificicial referee, other team's robots, or the simulation world's constraints.

## 3.4 Communication

3.4.1 Robots may communicate within each team in the scope of the simulation, as long as they abide by rule Rule 3.3, Interference.

3.4.2 Robots may not communicate with anything outside of the simulation world.

## 3.5 Agility

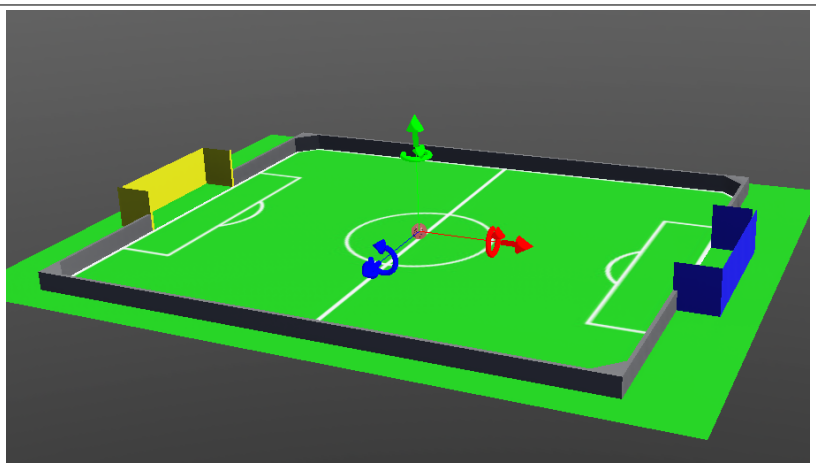
3.5.1 The construction of the robots is pre-defined and part of the simulation world. The robots will have a cubic form, two motorized wheels and no kicker.

3.5.2 Robots may be programmed with a controller script. They may turn in any direction, as well as drive forward and backward anywhere on the field. There is a maximum speed defined by the simulation. There is no mandatory behaviour required for the programs.

# 4 FIELD

4.0.1 The playing field will be provided by the OC as a digital Webots world, along with a small tutorial on how to place and move the robots during the game, as well as measure the robot and ball positions.

**Figure 2** An empty field with its reference frame in the center: X (red) and Y (blue).



## 4.1 Neutral Spots

4.1.1 There are 7 neutral spots. They are defined in simulation units as follows:

| Nr. | Name | X-Coordinate | Y-Coordinate |
|---|---|---|---|
| 1 | Central Point | 0 | 0 |
| 2 | Blue Side | 0.2 | 0 |
| 3 | Blue Side | 0.3 | 0.3 |
| 4 | Blue Side | 0.3 | -0.3 |
| 5 | Yellow Side | -0.2 | 0 |
| 6 | Yellow Side | -0.3 | 0.3 |
| 7 | Yellow Side | -0.3 | -0.3 |

**Figure 3** The ball and the 6 robots on the 7 neutral spots as defined in Rule 4.1, Neutral Spots

# 5 CODE OF CONDUCT

## 5.1 Fair Play

5.1.1 It is expected that the aim of all teams is to play a fair and clean game of robot soccer.

5.1.2 Programs are not allowed to cause interference with other robots or the referee during normal game play.

5.1.3 Programs are not allowed to cause interference to the field or to the ball during normal game play.

## 5.2 Behavior

5.2.1 All participants are expected to behave themselves. All behavior is to be of a subdued nature within the tournament.

## 5.3 Help

5.3.1 Mentors (teachers, parents, chaperones, and other adult team-members including translators) are not allowed to work on the teams' programs.

5.3.2 **Mentors must not touch, build or program any programs.**

## 5.4 Sharing

5.4.1 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.

5.4.2 All the code must be shared with other participants and made open-source after the tournament.

5.4.3 Also, if you find any bugs within the simulation world or the artificial referee (except for the Webots logo), please let us know.

## 5.5 Spirit

5.5.1 It is expected that all participants, students, mentors, and parents will respect the RoboCupJunior mission.

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

## 5.6 Violations / Disqualification

5.6.1 Teams that violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify only single person or single program from further participation in the tournament.

5.6.2 In less severe cases of violations of the code of conduct, a team will be given a warning (a yellow card). In severe or repeated cases of violations of the code of conduct a team can be disqualified immediately without a warning by a red card.

# 6 CONFLICT RESOLUTION

## 6.1 Artificial Referee

6.1.1 During a match, the artificial referee is a program in charge of making decisions with regards to the game and according to these rules.

6.1.2 During gameplay, the decisions made by the artificial referee are final.

6.1.3 At the conclusion of the game, the result recorded is final.

## 6.2 Rule Clarification

6.2.1 Rule clarification may be made by members of the RoboCupJunior Soccer Technical Committee and Organizing Committee, if necessary even during a tournament.

## 6.3 Rule Modification

6.3.1 If special circumstances, such as unforeseen problems or capabilities of a robot occur, rules may be modified by the RoboCupJunior Soccer Organizing Committee Chair in conjunction with available Technical Committee and Organizing Committee members, if necessary even during a tournament.

## 6.4 Regulatory Statutes

6.4.1 Each RoboCupJunior competition may have its own regulatory statutes to define the procedure of the tournament (for example the SuperTeam system, game modes, the inspection of programs, interviews, schedules, etc.). Regulatory statutes become a part of this rule.

# 7 INTERNATIONAL COMPETITION

## 7.1 Team

7.1.1 The maximum team size is 4 members for teams competing in the RoboCupJunior Soccer Simulation Challenge 2021.

7.1.2 Team members can participate independently of their participation in earlier RoboCupJunior Soccer Leagues.

## 7.2 Interviews

7.2.1 During the international competition, the Organizing Committee may arrange to interview teams during the event. The exact schedule will be published by the Organization Committee prior to the event.

7.2.2 During an interview, at least one member from each team must be able to explain particularities about the team's robots, especially with regards to its strategy and its programming. An interviewer may ask the team for a demonstration. The interviewer may also ask the team to write a simple program during the interview to verify that the team is able to program its robot.

7.2.3 All teams are expected to be able to conduct the interview in English. If this poses a problem, the team may ask for a translator to be present at the interview. If the OC is not able to provide a translator, the team is required to do so. During the interview, the team will be evaluated using so called Rubrics, which are published on the website mentioned in the beginning of these rules.

7.2.4 The Technical Committee recommends the implementation of interviews in regional competitions as well, but this is not mandatory.

## 7.3 Poster Sessions

7.3.1 During the international competition, the Organizing Committee may also arrange digital poster sessions for the teams to attend. The poster sessions will be held online. Details will be published prior to the competition.

## 7.4 Technical Challenges

7.4.1 Inspired by the major leagues and the need for further technological advancement of the leagues, the Technical Committee has decided to conduct so called **Technical Challenges**.

7.4.2 The idea of these challenges is to give the teams an opportunity to show off various abilities of their robots which may not get noticed during the regular games. Furthermore, the Technical Committee envisions these challenges to be a place for testing new ideas that may make it to the future rules, or otherwise shape the competition.

7.4.3 Any RoboCupJunior Soccer team will be eligible to try to tackle these challenges. Unless otherwise stated, any robot taking part in these challenges needs to abide by these rules in order to successfully complete it.

7.4.4 The technical challenges will be published prior to the competition, or during competition days.