

## Laws of the Game

### **RoboCup Humanoid Open Soccer Competition Rules (Demonstration) – DRAFT**

#### Motivation

The goal of the RoboCup Humanoid Open Soccer Competition (HOC) is two-fold:

The first goal is to allow teams that would like to join the RoboCup Humanoid League (HL), but find the rules and regulations of the HL too daunting, a platform to demonstrate their research. For example, a team may focus on highly dynamic motions and develop a single robot without a torso instead of having to develop a full team.

The second goal is to present a simplified entry for teams that plan to join the HL in the future. A particular target group for this initiative are participants of the RC Junior (Jr) competition.

#### Preface

In the RoboCup Humanoid Open Soccer Competition (HOSC), teams prepare a single autonomous robot to compete in robot soccer matches. Robots must look for a ball and try to score a goal. The league shall allow a simplified approach with a lessened learning curve to humanoid robot soccer and allow experimentation with different humanoid robot designs and technologies.

Robot teams only consist of field players to facilitate the competition. Robots must be designed, constructed and programmed by team members. Robot teams of 2 – 6 players are formed for each game and new teams formed throughout the tournament.

#### Field of Play

The HOSC is played on a special field built in a way that resembles the actual field for human soccer. The field is of green color and may be covered with an artificial grass with a maximum leaf length of 30mm. The field size should not be less than 6 \* 4.5 meters. Yellow, respectively blue cardboard figures represent the goal keepers. They are suspended from the respective goal's cross bars, reaching the floor and cover less than 50% of the goal width. Both figures have the same form. They are positioned by the referee, who may change their position during any stoppage of the game.

##### 1. The Ball

The ball is a FIFA size 1 ball with at least 50% orange colored surface.

##### 2. The Teams

The teams consist of 2 – 6 randomly chosen robots and change during the tournament. Robot team members are determined at least two hours prior to the game.

### 3. The Robot Players

The robot players are bipedal autonomous robots that walk on two legs and can drive a ball by pushing or kicking. Robots must act autonomously while a competition is running. No external power supply, teleoperation, remote control, or remote brain of any kind is allowed.

The maximum size of the robots is 1 meter, the maximum weight is 10 kg. Robots must be mostly black or of dark grey and non-reflective color. Robots may also be colored in aluminum-like silver, grey or white. Any color used for the field (green, yellow and blue) or the ball (orange) or similar colors must be avoided. The robots must be marked with team markers. These markers are colored Cyan RGB (0,255,255) for one team and Magenta RGB (255,0,255) for the other team.

Robots need to be equipped with a handle to be safely picked up and an emergency switch off that is clearly marked and fast and safely reachable. Robots must be constructed in a way that they can be started by a robot handler without the help of another person.

For the construction of a robot, any robot kit or building block may be used as long as the design and construction are primarily and substantially the original work of the team. This means that commercial kits may be used but must be substantially modified by the team. Robots must be programmed exclusively by student members of the team.

Robots must be constructed in a robust way. They must maintain structural integrity during contact with the field, the ball, or other robots. Their sensing systems must be able to tolerate significant levels of noise and disturbance caused by other robots, the referees, robot handlers, and the audience.

Robots not capable of play (e.g. robots not able to walk on two legs, robots not able to stand, or robots with obvious malfunctions) or damaged robots are not permitted to participate in the game. They must be removed from the field. It is up to the referee to judge whether a robot is capable of play.

A robot is damaged especially when:

- it does not respond to the ball, or is not able to move (it lost pieces, power, etc.),
- it continually moves into the goal or out of the playing field

### 4. The Referee

Each match is controlled by a team of referees with one head referee, who has full authority to enforce the Laws of the Game. The referee may ask the

team leader of a robot suspected to be incapable of play to demonstrate playing ability at any time.

Every participating team has to provide a team member for refereeing duties.

## 5. The Duration of the Match

A match is played in two half time periods of 10 minutes each with a break of 5 minutes. The game clock will run for the duration of the halves without stopping (except in the event when a referee wants to consult an official). The game clock will be run by a referee or a referee assistant.

Teams are supposed to be at their field 5 minutes before their game starts. In any situation, when the goal difference reaches 10, the game finishes regardless of the state of the game clock.

A team may extend a stoppage of the game by taking a timeout. During a timeout, robots may be serviced. Each team may take at most one timeout per period. A timeout ends automatically after 2 min. A timeout also ends when the team signals its end to the referee.

## 6. Start and Restart of Play

The play is started and restarted by a drop ball at the kick-off point at the center. The ball is in play for both teams. Goals may be scored immediately.

A game is restarted for:

- second halftime,
- after a goal was scored,
- after half of the robots of a robot team became inactive or removed (for whatever reason),
- stuck game situation, e.g. if there is no progress of the game for 1 min.

For start and restart of the game, all robots must be halted. Robots are placed and possibly manually started upon the respective commands of the referee by the respective robot handler. Robots may be started manually at the touch line of their team's own half. Robots that are started remotely, e.g. by the humanoid leagues game controller, may be positioned anywhere in their own half.

Robots may move immediately after the referee gives the signal, typically by whistling. Any robot that is started early will be removed from the field and treated as a damaged robot.

After positioning and possibly starting the robots, human team members must not interfere with the game play, except if explicitly called for by the referee. Pick-up of robots by robot handler only is allowed during stoppage of the game. I.e. except for the kick-off, human interference by the teams (e.g. touching the robots) during the game is not allowed unless explicitly permitted

by a referee. Violating teams or team member(s) can be disqualified from the game.

Before a restart, all removed robots are allowed to return to the playing field immediately if they are ready and fully functional.

## 7. The Ball In and Out of Play

If the ball leaves the field of play, it is returned to field by the referee or an assistant referee, one meter into the field at the point where it left the field. There is no stoppage of the game. The ball is in play at all other times, including when it rebounds from a goalpost, crossbar, human, or robot and remains in the field of play.

## 8. The Method of Scoring

A goal is scored if the ball completely crossed the goal line between the two goal posts.

When a goal is scored, all robots of the scoring team on the field receive 1 point and the robot who scored the goal receives an additional point if it was not an own goal. A robot is considered to be on the field if both feet of the robot are fully inside the field area. The robot who scored the goal receives the points regardless of its position on the field. Incapable robot, penalized robots, robots outside the field or robots having been removed for any other reason, e.g. service, will receive no point. When a goal is suffered, all robots of the team suffering the goal receive -1 points, including incapable robots, penalized robots or robots having been removed for any other reason, e.g. in service. Points from all games are summed up. For robots who played one or more games more than the others, only the points of those games with the higher scores are considered.

Robot players with a positive score are initially ranked according to the accumulated points. If there are ties, the tied robots are ranked according to the number of games played, the maximum points awarded in a single game and the number of goals scored (in this order).

If the three best robot players cannot be identified with the scheme provided above, an additional game with robots drawn group wise from the highest-ranked robots with a total number of points greater than zero or from the four robots with the highest scores is to be played. If there are still ties, the ranking is determined by a penalty shoot-out.

## 9. Fouls and Misconducts

The following cases are considered as fouls, resulting in a 60 seconds removal penalty:

- any action posing the potential of significantly damaging a robot, including itself,
- leaving the playing field (field of play and surrounding green surface),

- holding a ball, i.e. taking full control of the ball by removing all of its degrees of freedom and access for other robots,
- any other significant offence, e.g. obstructing the game, as considered by the referee.

Robots potentially endangering humans by whatever activity are excluded from the game (red card).

## CODE OF CONDUCT

The aim of all teams is to play a fair and clean game of robot soccer. All robots will be built with consideration to other participants.

Robots must not cause deliberate interference with or damage to other robots during game play. Robots do not cause damage to the field or to the ball during game play.

Humans do not cause deliberate interference with robots or damage to the field or the ball.

All participants are expected to act in a sportsmanlike manner at all times.

The understanding that any technological and curricular developments should be shared among the RoboCup participants after the tournament has been a part of the world RoboCup competitions and it is encouraged that teams share their work after the competition.

Participants, individually or as a team, who violate the code of conduct may be disqualified from the tournament. In less severe cases of violations of the code of conduct, a team will be given a warning by showing it a yellow card. In severe or repeated cases of violations of the code of conduct, participants may be disqualified immediately without warning by showing it the red card.