



# RoboCupJunior Soccer Rules 2011

RoboCupJunior Soccer Technical Committee 2011:

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These are the official rules for RoboCupJunior 2011. They are released by the RoboCupJunior Soccer Technical Committee. These rules have priority over any translations.

## 1. TEAM

### **1.1 Regulations**

A **team** consists of one or more members.

Each team must have a **captain**. The captain is the person responsible for communication with the referee. A team can replace its captain during the competition. The captain is not allowed to wear any yellow or blue clothes that can be seen by robots (to avoid interference with the goal colour).

### **1.2 Violations**

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

A referee can require the team captain to change clothes or to be replaced by another team member if interference with goal colour is suspected.

## 2. ROBOTS

### **2.1 Number of robots / substitution**

Each team is allowed to have at most two robots. A substitution of robots within a team or with other teams is forbidden.

### **2.2 Interference**

Robots are not allowed to be coloured yellow or blue in order to avoid interference with the goal colours. Yellow or blue parts used in the construction of the robot must either be covered by other parts from the perception by other robots or be taped/painted with a neutral colour.

The robot must not emit infrared light. Infrared light reflecting materials must not be used on the outside. If robots are painted, they must be painted matte.

Minor parts are irrelevant as long as opposing robots are not affected. The supposed affected team has the burden of proof that is affected.

### **2.3 Control**

The use of remote control of any kind is not allowed. Robots must be started manually by humans and be controlled autonomously.

### **2.4 Communication**

Robots are not allowed to use any kind of communication during game play. Communication between two robots via bluetooth class 2 or class 3 (range approximately 20 meters) is allowed. Teams are responsible for their communication. The availability of frequencies cannot be guaranteed.



## 2.5 Agility

Robots must be constructed and programmed in a way that their movement is not limited to only one dimension (that means one axis). They must move in all directions, for example by turning. Robots must respond to a ball in a direct forward movement. For example, it is not enough to basically just move left and right in front of their own goal, but also to move directly towards the ball in a forward movement.

Robots must be constructed and programmed in a way that they do not enter a goal. Robots are allowed to use their cross-bar.

## 2.6 Handle

All robots must have a stable handle to hold and to lift them. The handle must be easily accessible, for example on top of a robot. The dimensions of the handle may exceed the 22 cm height limitation. The handle must not be used to mount components on a robot.

## 2.7 Additional regulations of the sub-leagues

A tournament may be organized in different sub-leagues. Each sub-league (e.g. "Open League" and "Light Weight League") may have its own additional regulations, including regulations affecting the construction of robots. Such regulations will be passed by the RoboCupJunior Soccer Technical Committee and become a part of this rule.

## 2.8 Violations

Robots that do not abide by the above specifications/regulations are not allowed to play. If violations are detected during a running game the team is disqualified for that game. If similar violations occur repeatedly, the team can be disqualified from the tournament.

# **3. FIELD**

## 3.1 Kinds of fields

Two different kinds of fields, named SOCCER A and SOCCER B, may be used at a tournament.

## 3.2 Dimensions of field

SOCCER A: The playing-field is 122 cm by 183 cm. The corners are flattened.

SOCCER B: The playing-field is 122 cm by 183 cm. Around the field is an out-area of 30 cm width. Total dimensions of the field, including the out-area, are 182 cm by 243 cm. The field is marked by a white line between 10 mm and 20 mm width. The line is part of the field.

## 3.3 Walls

Walls are placed all around the field, including behind the goals and, if applicable, the out-area. The height of the walls is 14 cm. The walls are painted matte black.

## 3.4 Goals

SOCCER A: The width of each goal is 45 cm, centered on each of the shorter sides of the playing-field. The goal is 14 cm high. It has a cross-bar on top (to prevent robots from entering the goal). The interior of one goal including floor, walls and cross-bar are painted in yellow, and the other goal in blue. The exterior is painted in black.

SOCCER B: The width of each goal is 60 cm, centered on each of the shorter sides of the playing-field. The goal is 10 cm high. It has a cross-bar on top (to prevent robots from entering the goal). The interior of one goal including floor, walls and cross-bar are painted in yellow, the other goal in blue. The exterior is painted in black.

## 3.5 Floor



The floor consists of green carpet on top of a hard surface.

### **3.6 Neutral sports**

There are five neutral spots defined in a field. One is in the center of the field. The other four are adjacent to each corner, located 45 cm along the long edge of the field, aligned with each goal post towards the middle of the field (from the goal post). The spots are marked black.

### **3.7 Center circle**

A center circle will be drawn on a field. It is 60 cm in diameter. It is a thin black marker line. It is there for referees and captains as a guidance during kick-off.

### **3.8 Penalty areas**

SOCCER A: In front of each goal there is a 30 cm wide and 75 cm long penalty area.

SOCCER B: In front of each goal there is a 30 cm wide and 90 cm long penalty area.

SOCCER A and SOCCER B: Penalty areas are marked by a white line between 10 mm and 20 mm width. The line is part of the area.

A robot is considered inside a penalty area when it is completely inside.

### **3.9 Lighting and Magnetic Conditions**

Fields should be placed in a way that influences from external infrared lights and any influences that interfere with the magnetic field of the earth are as minimal as possible. Perfect conditions cannot be guaranteed. Teams must come to tournaments being prepared to calibrate their robots based on the lighting and magnetic conditions at a venue.

## **4. BALL**

### **4.1 General ball specification**

A well-balanced electronic ball shall be used. The ball will emit infrared (IR) light. **For SOCCER A and SOCCER B, a pulsed ball will be used.**

### **4.2 Official suppliers for pulsed balls**

Currently, there is one ball that has been approved by the RoboCupJunior Soccer Technical Committee:

- RoboSoccer RCJ-05 ball operated in MODE A (pulsed)  
made by EK Japan/Elekit ([www.elekit.co.jp](http://www.elekit.co.jp))

Technical details are in the "Technical Specification for pulsed Soccer Ball" which is attached at the end of the document.

### **4.3 Tournament balls**

Balls for the tournament must be made available by organizers. Organizers are not responsible for providing balls for practice.

## **5. GAME PLAY**

### **5.1 Game procedure and length of a game**

A game will consist of two halves. The duration of each half is 10-minutes. There will be a 5-minute break in between the halves.



A game clock will run for the duration of the halves without stopping (except if or when the referee wants to consult an official). The game clock will be run by a referee or an assistant.

Teams are supposed to be at an assigned table/field 5 minutes before their game starts. Teams can be penalized one goal per minute at a referee's discretion if they are late for the game start. If a team does not report within 5 minutes of the game start, it is considered a forfeit of the game and the winning team is awarded a 5-0 win.

## **5.2 Pre-match meeting**

At the start of the first half of a game, a referee will toss a coin. The team mentioned first in the draw shall call the coin. The winner of the toss can choose either their side of a field, or kick off. After the first half, teams will 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.

## **5.3 Kick off**

Each half of a game begins with a kick off. All robots must be located on their own side of the field. All robots must be still with no parts moving. A ball is positioned by the referee in the center of a field.

The team kicking off places their robots on the field first. Robots cannot be placed nor remain behind the goal line or in the out area. Robots cannot be moved once they are placed.

The team not kicking off will place their robots on the defensive end of the field. All robots on the team not kicking off must be at least 30 cm away from the ball (that means outside the center circle).

The referee may adjust the placement of the robots.

On the referee's command (usually by whistle), all robots will be started immediately by each captain. Any robots that are started early will be removed by the referee from the field and treated as a damaged robot.

## **5.4 Human interference**

Except for the kick-off, human interference (e.g. touching the robots) during the game is not allowed unless explicitly permitted by the referee. Violators can be disqualified from the game.

## **5.5 Ball movement**

A robot cannot hold a ball. Holding a ball means taking full control of the ball by removing all of its degrees of freedom. Examples of ball holding include fixing a ball to a robot's body, surrounding a ball using a robot's body to prevent access by others, and encircling the ball or somehow trapping the ball with any part of a robot's body. If a ball stops rolling while a robot is moving or a ball does not rebound when rolled into a robot, it is a good indication that the ball is trapped.

The only exception to holding is the use of a rotating drum that imparts dynamic back spin on a ball to keep the ball on its surface. Such a device is called a dribbler.

Other players must be able to access a ball.

## **5.6 Scoring**

A goal is scored when the entire ball is inside the goal or if it strikes the back wall of the goal.

## **5.7 Goalie**

A robot moving first into the penalty area completely (with every part of it) on a team's defending side is designated as goalie until a part of it leaves the penalty area.

## **5.8 Pushing**

Within a penalty area, a goalie has priority. Attacking robots are not supposed to push the goalie in any way.



If an attacker and a goalie touch each other and at least one of them has physical contact with a ball, the ball will be moved to the nearest unoccupied neutral spot immediately.

If a goal is scored as a result of this pushed-situation, a point will not be awarded.

### 5.9 Lack of progress

**Lack of progress** occurs if there is no progress in the gameplay for a reasonable period of time and the situation is not likely to change. Typical lack of progress situations are when the ball is stuck between robots or between the robot and the wall or no robot is able to detect the ball at its location. The referee will call “lack of progress” and will move the ball to the nearest unoccupied neutral spot. If this does not solve the lack of progress, the referee can move the ball to different a neutral spot.

### 5.10 Out (in SOCCER B only)

The ball is considered as **out** if the entire ball is out of the playing area. If a ball is out, the referee will reposition the ball on a neutral spot. The captain of the team whose robots did not touch the ball last can choose between the two neutral spots on the side of the field where the ball went out of. If one of these neutral spots is occupied by a robot, the captain can also choose to reposition the ball to the center of the field. The decision of the captain must be made immediately by pointing to a neutral spot. If the captain does not decide immediately, the referee will choose a neutral spot.

### 5.11 Damaged robots

If a robot is damaged, it has to be taken off the field and must be fixed before it can play again. A damaged robot must remain off the field for at least one minute.

A robot is damaged especially when:

- it does not respond to a ball
- it continually moves into a goal
- it turns over on its own accord
- it is stuck to a wall or a corner and cannot free itself continually

After a robot has been fixed and one minute is past, it will be placed on the unoccupied neutral spot nearest to where it has been taken off, and not directly aiming towards to a ball. A robot can only be returned to the field if the damage has been repaired.

Only a referee decides whether a robot is damaged. A robot can only be taken off or returned with the referee’s permission.

### 5.12 Multiple defense

Multiple defense occurs if more than one robot from the defending team enters its penalty area with some part, and substantially affects the game. The robot farther from a ball will be moved to the center neutral spot.

If multiple defence happens repeatedly, one of the robots will be deemed damaged.

### 5.13 Interruption of Game

In principle, a game will not be stopped.

A referee can stop a game if there is a situation on or around a field, which the referee wants to discuss with an official of the tournament **or if a ball malfunctions and a replacement is not readily available.**

When a referee has stopped a game, all robots must be stopped and remain on the field untouched. The referee may decide whether the game will be continued/resumed from the situation in which the game was stopped or by a kick off.

## 6. CODE OF CONDUCT

### 6.1 Fair Play



It is expected that the aim of all teams is to play a fair and clean game of robot soccer. It is expected that all robots will be built with consideration to other participants.

Robots are not allowed to cause deliberate interference with or damage to other robots during a normal game play.

Robots are not allowed to cause damage to a field or a ball during a normal game play.

Humans are not allowed to cause deliberate interference with robots or damage to a field or a ball.

## **6.2 Behavior**

All participants are expected to behave themselves. All movement and behavior is to be of a subdued nature within a tournament venue.

## **6.3 Help**

Mentors (teachers, parents, chaperones and other adult team-members) are not allowed in the student work area without the organizer's permission. Only participating students are allowed to be inside the work area.

Mentors must not touch, build, repair or program any robots.

The substitution of robots during the competition within a team or with other teams is forbidden.

## **6.4 Sharing**

An understanding that has been a part of world RoboCup and RoboCupJunior competitions is that technological and curricular developments should be shared with other participants during and after the competition.

## **6.5 Spirit**

It is expected that all participants, students, mentors and parents alike, will respect the RoboCupJunior mission. *It is not whether you win or lose, but how much you learn that counts!*

## **6.6 Violations / Disqualification**

Teams who violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify and exclude from further participation in the tournament only a single person or a single robot.

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 a team can be disqualified immediately without a warning by showing it the red card.

# **7. CONFLICT RESOLUTION**

## **7.1 Referee and referee assistant**

All decisions during the game are made by the referee or the referee assistant, who are in charge of a table/field, and people and objects surrounding it. During game play, the referees' decisions are final.

Any argument with a referee or an assistant can result in a warning. If the argument continues or another argument occurs, this may result in immediate disqualification from the game.

At the conclusion of a game, the referee will ask the captains to sign a score sheet. By signing the score sheet the captains accept the final score on behalf of their team.

## **7.2 Rule clarification**

Rule clarification may be made by members of the RoboCupJunior Soccer Technical Committee if necessary.

## **7.3 Rule modification**

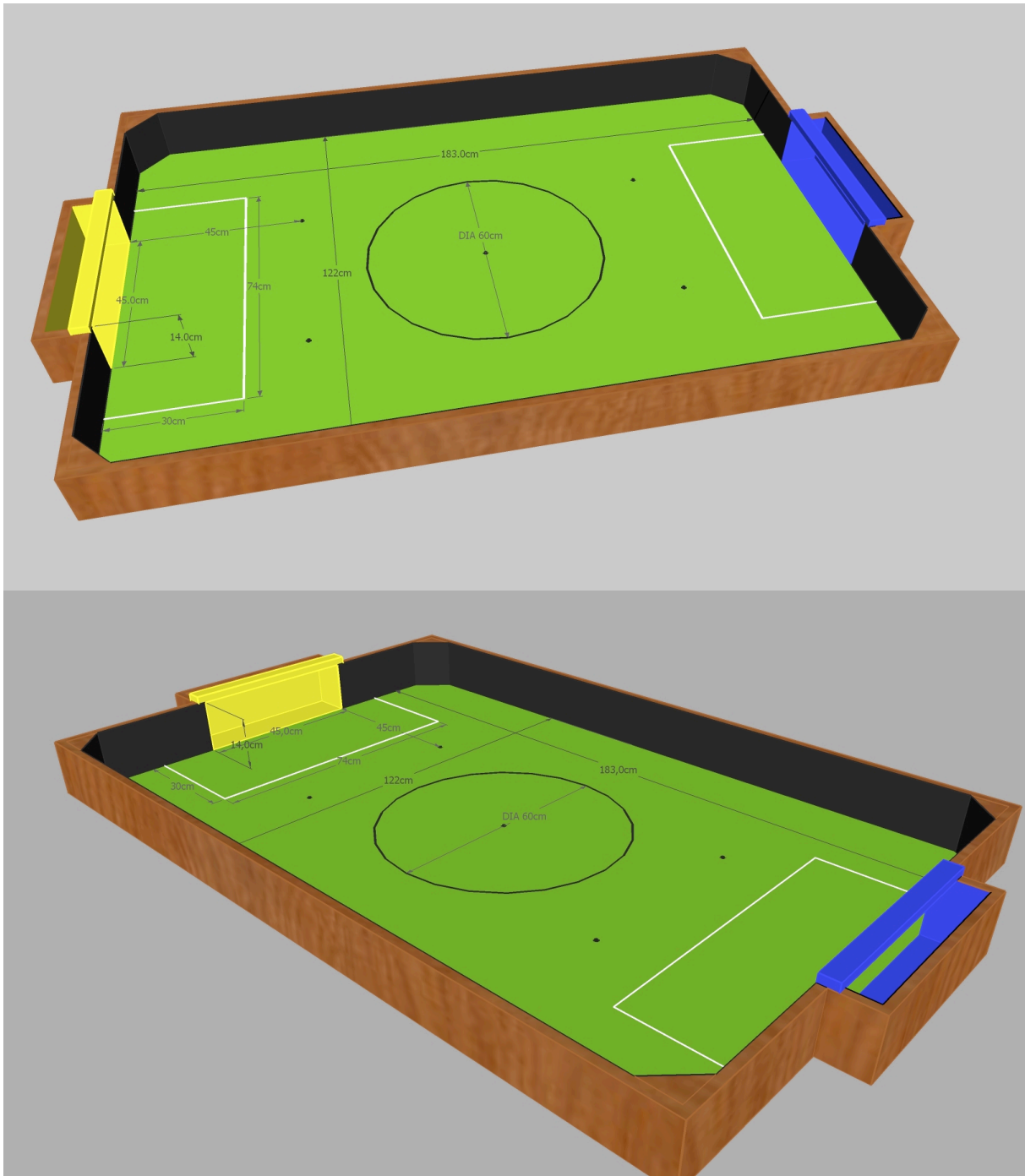


If special circumstances, such as unforeseen problems or capabilities of a robot, occur, rules may be modified by members of the RoboCupJunior Soccer Technical Committee if necessary.

#### **7.4 Regulatory statutes**

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 robots, interviews, schedules, etc.). Regulatory statutes become a part of this rule.

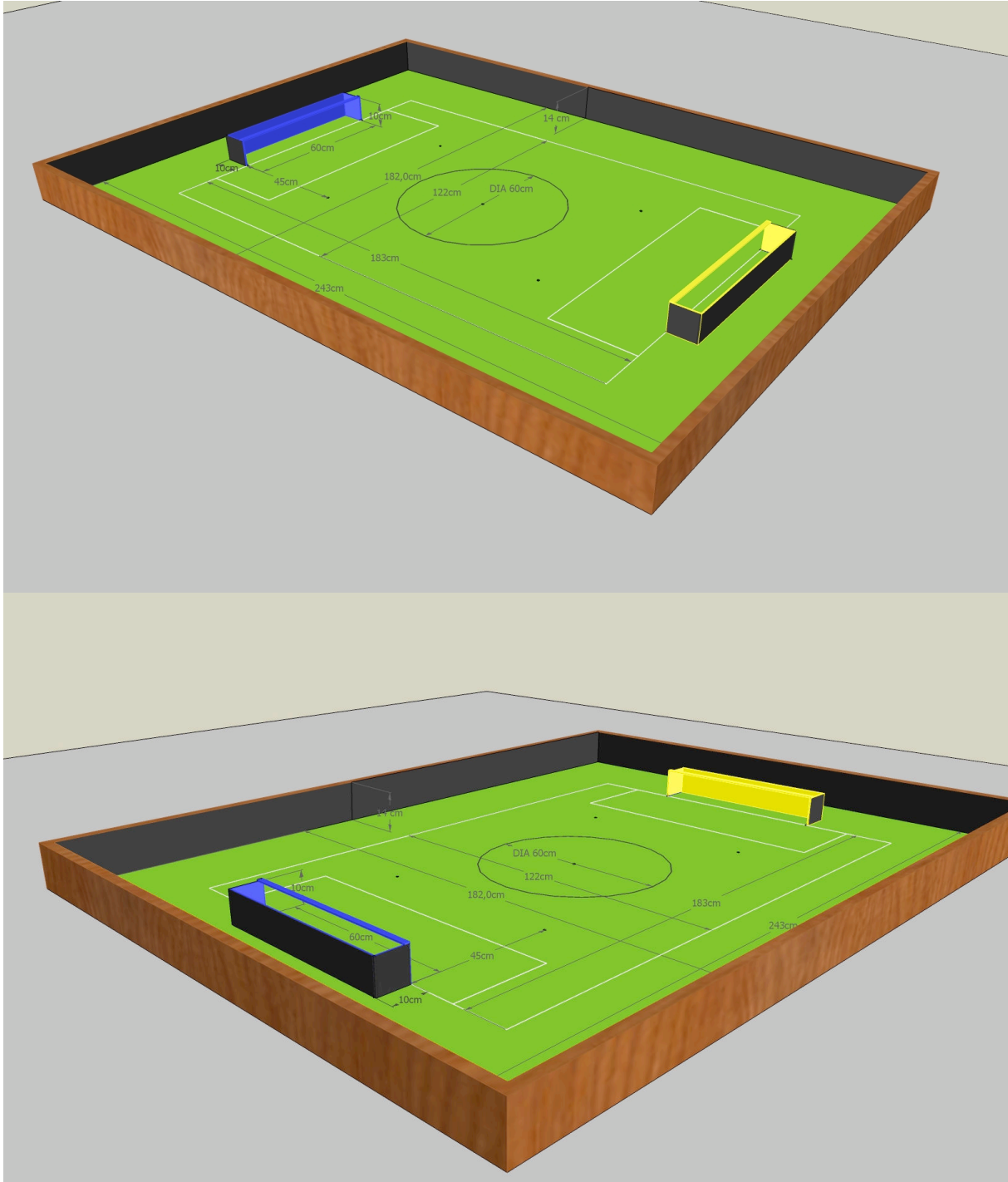
# SOCCKER A field



Grafics designed by Ricardo Sampaio



# SOCCKER B field



Grafics designed by Ricardo Sampaio

# League Regulations 2011

## 1. Preamble

According to rule 2.7 of the RoboCupJunior Soccer Rules, each league has its own additional regulations. They become a part of the rules.

Soccer will consist of two sub-leagues. These sub-leagues are called “**Open League**” and “**Light Weight League**”. They differ only in the weight of the robots. **Each sub-league can be further divided into primary and secondary.**

## 2. Regulations

### **2.1 Dimensions**

Robots will be measured in an upright position with all parts extended. A robot’s dimensions must not exceed the following limits:

sub-league	Open League	Light Weight League
size / diameter	22.0 cm	22.0 cm
height	22.0 cm *	22.0 cm *
weight	2500 g **	1250 g **
ball-capturing zone	3.0 cm	3.0 cm

\* The handle of a robot may exceed the height.

\*\* The weight of the robot includes that of the handle.

Ball-capturing zone is defined as any internal space created when a straight edge is placed on the protruding points of a robot. This means that the ball must not enter the concave hull of a robot by more than 3 cm. Furthermore, it must be possible for another robot to take possession of the ball.

### **2.2 Construction**

Robots must be constructed exclusively by student members of a team. Mentors, teachers, parents or companies may not be involved in the design, construction, and assembly of robots.

For the construction of the robots 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. It is neither allowed to mainly follow a construction manual, nor to make minor changes.

Indications for the violation are the use of commercial kits that can be assembled in only one way or robots are taken from other teams.

Robots must be constructed in a way that they can be started by the captain without the help of another person.

### **2.3 Programming**

Robots must be programmed exclusively by student members of a team. Mentors, teachers, parents or companies must not be involved in the programming and debugging of robots.

For the programming of the robots any programming language, interface or integrated development environment (IDE) may be used. The use of programs that come together with a commercial kit (especially sample programs or presets) or substantial parts of such programs are not allowed.

It is not allowed to use sample programs, not even with modifications.

### **2.4 Burden of proof**



Proof must be supplied by each team that their robots match these regulations, for example by a detailed documentation or log book. Teams may be interviewed about their robots and the development process at any time during a tournament.

## **2.5 Violations**

Robots that do not match the above regulations are not allowed to play. If violations are detected during a running game, the team is disqualified for that game. If similar violations occur repeatedly, the team can be disqualified from the tournament.

# Technical Specification for pulsed Soccer Ball

## 1. Preamble

Answering to the request for a soccer ball for RCJ tournaments (more robust to interfering lights, less energy consuming, and mechanically more resistant), the RCJ Soccer Technical Committee defined the following technical specifications with the special collaboration from EK Japan and HiTechnic.

Producers of these balls must apply for a certification process upon which they can exhibit the RCJ-compliant label and their balls used in RCJ tournaments.

Balls with these specifications can be detected using specific sensors from HiTechnic (IRSeeker - information on distance and angle) but also common IR remote control receivers (TSOP1140, TSOP1240, GP1UX511QS, ... - on-off detection with a possible gross indication of distance).

## 2. Specifications

### **2.1 IR light**

The ball emits infra-red (IR) light with wavelengths in the range 920nm - 960nm, and pulsed at a square-wave carrier frequency of 40kHz. The ball should have enough ultra bright and wide angle LEDs to minimize unevenness of the IR output.

### **2.2 Diameter**

The diameter of the ball shall be in the range 74mm - 80mm. A well-balanced ball shall be used.

### **2.3 Drop Test**

The ball must be able to resist normal game play. As an indication of its durability, it should be able to survive/undamaged a free-fall from 1.5 meters onto a hardwood table or floor.

### **2.4 Modulation**

The 40kHz carrier output of the ball shall be modulated with a trapezoidal (stepped) waveform of frequency 1.2kHz. Each 833-microsecond cycle of the modulation waveform shall comprise 8 carrier pulses at full intensity, followed (in turn) by 4 carrier pulses at 1/4 of full intensity, four pulses at 1/16 of full intensity and four pulses at 1/64 of full intensity, followed by a space (i.e. zero intensity) of about 346 microseconds. The peak current level in the LEDs shall be within the range of 45-55mA. The radiant intensity shall be more than 20mW/sr per LED.

### **2.5 Battery Life**

If the ball has an embedded rechargeable battery, when new and fully charged it should last for more than 3 hours of continuous use before the brightness of the LEDs drops to 90% of the initial value. If the ball uses replaceable batteries, a set of new high-quality alkaline batteries should last for more than 8 hours of continuous use before the brightness of the LEDs drops to 90% of the initial value.

### **2.6 Coloration**

The ball shall be neutral in color. In particular, it must not have any green, blue or yellow coloration (to avoid confusion with the colors of the field and goals).