Middle Size Robot League Rules and Regulations for 2023

Version - 24.1 20230127

MSL Technical Committee 1997–2023

Minoru Asada
Tucker Balch
Andrea Bonarini
Ansgar Bredenfeld
Steffen Gutmann
Gerhard Kraetzschmar
Pedro Lima
Emanuele Menegatti
Pieter Jonker
Alireza Fadaei Tehrani
Takayuki Nakamura
Gerald Steinbauer
Martin Lauer
Yasunori Takemura
Huimin Lu
Enrico Pagello
Fernando Ribeiro
Thorsten Schmitt
Wei-Min Shen
Hans Sprong
Shoji Suzuki
Yasutake Takahashi
Paul G. Ploeger
Frank Schreiber
Jürge van Eijck
Akihiro Matsumoto
Saeed Shiry Ghidary
Roel Merry
Bernardo Cunha
Darwin Lau
Saeed Ebrahimijam
Oliver Zweigle
António J. R. Neves
José Miguel Almeida
Hamed Rasam Farad
Robin Soetens
Zhao Yong
Shota Chikushi
Wu Jia Hao
Masoud Montazeri
Junhao Xiao
Ricardo Dias
Andreas Witsch
Zhao Yong
Seyed Ehsan Marjani
Wouter Houtman
Yifei Han
Junchong Ma
Edwin Schreuder
Zhiqian Zhou
Xinzhe Lyu
Jorrit Olthuis
Valentin Gies
Ruben Beumer
Bin Lin
Bhre Satriavi

January 28, 2023

Disclaimer, Acknowledgements, and Copyright

Document Status

This is the draft version of the rules that will be used for the RoboCup Soccer World Championships, to be held in France and for MSL competitions in 2023.

Middle Size Robot League
– Rules and Regulations –

Preamble

Rules Philosophy:

1. RoboCup rules should not in any way describe the behaviour of how the game is played. Rules should only ensure that a fair competition takes place, and encourage both technical and creative development.

2. RoboCup rules should avoid to constrain the design of robots, including their mechanical construction, their use of sensory systems, communication equipment, etc., **unless** the constraints seem necessary to foster scientific progress or to ensure a fair competition.

   Example constraint: Global vision systems are not permitted in the Middle Size League.

3. Teams should avoid to search for gaps or inconsistencies in the rules to achieve advantages in specific game situations. If a team finds such gaps or inconsistencies, they are explicitly requested to report those to the technical committee.

Design Philosophy:

1. Each team should design their robots without making interpretations or placing expectations on how the environment around the field will look like, about spectators, what other teams will do, what robots should look like, or how they will behave.

2. Each team is under no obligation to accommodate modifications to their own robots to suit other teams. Any such modification is by mutual consent only.

Organization of Rules:

Rules and regulations for the RoboCup Middle Size robot League are given in two major sections:

1. Official FIFA Laws.
   They are reproduced in this document. FIFA Laws are annotated with RoboCup Changes and Comments as appropriate.

2. Competition Rules, which define issues like team qualification, etc., for a specific tournament like the annual RoboCup Robot Soccer World Championships.

Conflict Resolution Rules:

In case of any conflict between Laws and Rules:

1. Regulations specified as RoboCup Changes and Comments in the FIFA Laws section override FIFA Laws.
2. Regulations specified in Competition Laws override any FIFA Laws, including RoboCup Changes and Comments.

Download Sites

The current version of the rules can be downloaded as PDF document at

`https://msl.robocup.org/rules`.

Rule Change Proposals and Corrections

If you have found any contradictions or inconsistencies please contact the RoboCup Middle Size League mailing list

`robocup-mid@lists.robocup.org`,

or the MSL Technical Committee

`rc-msl-tc@lists.robocup.org`.

To (un)subscribe to the RoboCup Middle Size League mailing list please go to

`https://lists.robocup.org/listinfo/robocup-mid`.

Contents

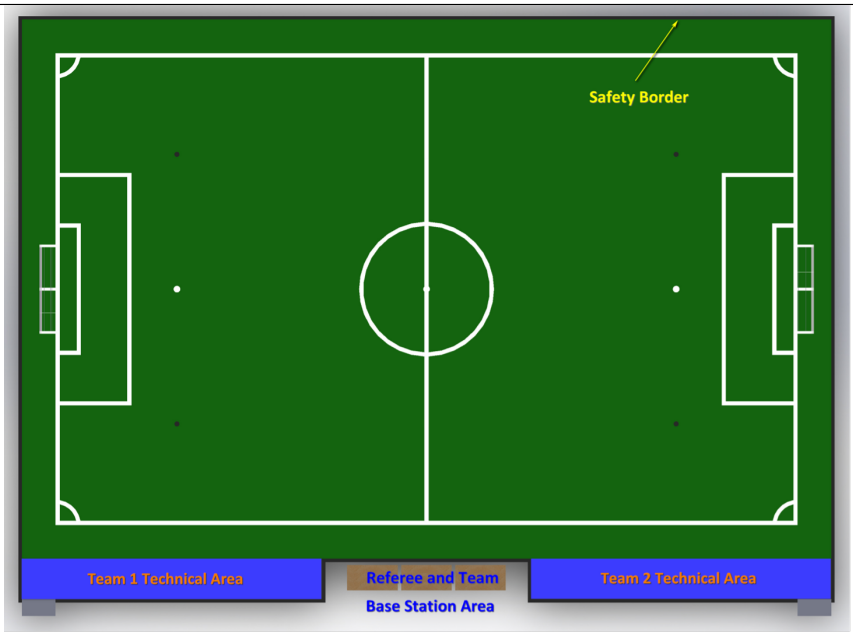
Chapter

FIFA Laws and RoboCup Modifications

Official FIFA Laws include:

- FIFA Law 1 - The Field of Play
- FIFA Law 2 - The Ball
- FIFA Law 3 - The Number of Players
- FIFA Law 4 - The Players' Equipment
- FIFA Law 5 - The Referee
- FIFA Law 6 - The Assistant Referees
- FIFA Law 7 - The Duration of the Match
- FIFA Law 8 - The Start and Restart of Play
- FIFA Law 9 - The Ball In and Out of Play
- FIFA Law 10 - The Method of Scoring
- FIFA Law 11 - Offside
- FIFA Law 12 - Fouls and Misconduct
- FIFA Law 13 - Free Kicks
- FIFA Law 14 - The Penalty Kick
- FIFA Law 15 - The Throw-In
- FIFA Law 16 - The Goal Kick
- FIFA Law 17 - The Corner Kick

FIFA LAW 1 – The Field of Play

RoboCup	RoboCup Changes and Comments
RC-1.0: The Field	
RC-1.0.1: Surface	Choosing a material for the floor is the responsibility of the local organizers of an event. The color of the field surface must be green.
RC-1.0.2: Lighting	Artificial light sources may be hung over the field.

FL 1.1 Dimensions

The field of play must be rectangular. The length of the touch line must be greater than the length of the goal line.

National Matches

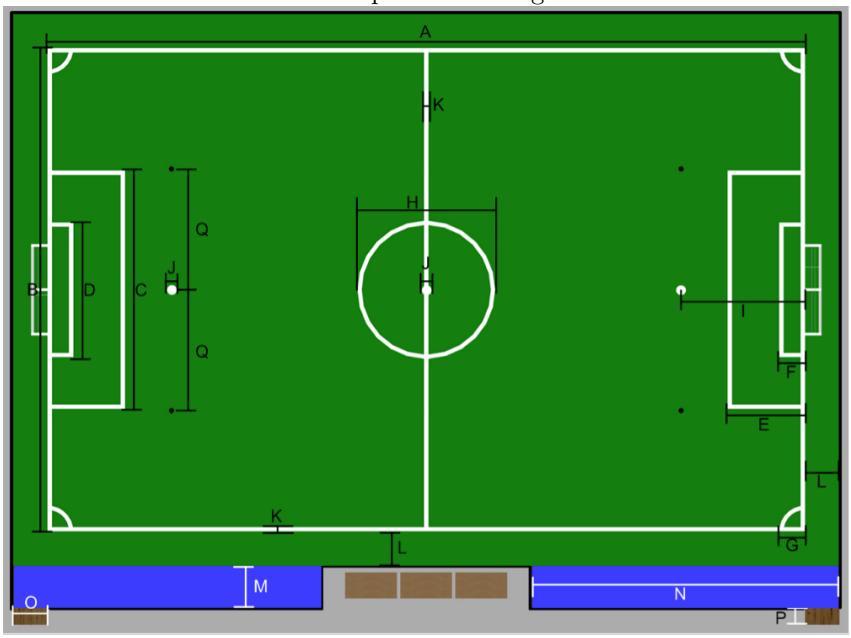
Length: minimum 90m (100yds), maximum 120m (130yds)
Width: minimum 45m (50yds), maximum 90m (100yds)

International Matches

Length: minimum 100m (110yds), maximum 110m (120yds)
Width: minimum 64m (70yds), maximum 75m (80yds)

Table FIFA LAW3: Overview of dimensions for a RoboCup field corresponding to the figure shown in RC-1.1.

$A = 22m$	$B = 14m$
$C = 6.9m$	$D = 3.9m$
$E = 2.25m$	$F = 0.75m$
$G = 0.75m$	$H = 4m$
$I = 3.6m$	$J = 0.15m$ (center and penalty marks)
$K = 0.125m$ (all lines width)	$L \geq 1m$
$M = 1m$	$7m < N \leq 8m$
$O = 1m$	$P \geq 0.5m$
$Q = 3.5m$	

RoboCup	**RoboCup Changes and Comments**
RC-1.1: Dimensions	**RoboCup Matches** Official matches are played on a field of 22m × 14m. **Local Tournaments** Depending on the feasibility by the LOC, a field of 18m × 12m may be used on Local Tournaments. Table FIFA LAW3 lists the dimensions for a full-size RoboCup field, Table FIFA LAW4 lists the dimensions for a reduced-size local tournament field. The labels of both tables correspond to the figure below: 

FL 1.2 Field Markings

The field of play is marked with lines. These lines belong to the areas of which they are boundaries. The two longer boundary lines are called touch lines. The two shorter lines are called goal lines. All lines are not more than 12.5cm (5ins) wide. The field of play is divided into two halves by a halfway line. The center mark is indicated at the midpoint of the halfway line. A circle with a radius of 9.15m (10yds) is marked around it.

Table FIFA LAW4: Overview of dimensions for a small (local tournament) field corresponding to the figure shown in RC-1.1.

$A = 18m$	$B = 12m$
$C = 6.5m$	$D = 3.5m$
$E = 2.25m$	$F = 0.75m$
$G = 0.75m$	$H = 4m$
$I = 3m$	$J = 0.15m$ (center and penalty marks)
$K = 0.125m$ (all lines width)	$L \geq 1m$
$M = 1m$	$5m < N \leq 6m$
$O = 1m$	$P \geq 0.5m$
$Q = 3m$	

	**RoboCup Changes and Comments**
RC-1.2: Field Markings	The width of touch and goal lines is 12.5cm. The radius of the center circle is 2m. For RoboCup, the width of all internal lines, like center circle, goal area, and penalty area, is also 12.5cm. Lines are part of the areas they delimit. Therefore measurements are to be taken from the outside of the lines regarding each of these areas.
RC-1.2.1: Safety Boundary	The field is surrounded by a black safety boundary, the height of which is between 8cm and 15cm above the field. It is placed at least 1m outside of each field border. The purpose for this boundary is to ensure safety and preventing robots from running into the audience. Further implementation details are defined in the MSL competition construction book. All teams are expected to make no assumptions about this boundary, namely about its mechanical resistance. Thus the above height constraints might be changed by the organizer within their limits without prior notice.
RC-1.2.2: Ad Panels	The organizers may place ad panels. The length of a panel may not exceed 150 cm and the height may not exceed 50 cm. Panels must be placed outside of the safety boundary. The ad panels are not intended for localization.
RC-1.2.3: Restart Spots	The RoboCup field defines 7 places used for game restart. In addition to the white center marking and the white penalty marks, there are 4 extra virtual spots on the field which will be used for this purpose. The positions of these extra virtual spots (see black dots in the field drawing above) are specified as follows: 2 spots each on a line parallel to the goal line through each penalty mark, one each halfway between touch line and the penalty mark. The penalty marks are not used for game restarts, unless a penalty shoot out is called by the referee. The diameter of the center mark is 15cm, while the diameter of the white penalty marks is 10cm.
RC-1.2.4: Technical Areas	Of the same side of the field where the tables for the Referee Box Computer and Team Base Stations are located, two Team Technical Areas (TTAs) must exist at the exact same level of the remaining field of game. These areas must be at least 1m wide and at least 7m long. No Safety Boundary exists between the green carpet and these areas. Instead, the safety border should run outside the technical areas. The Team Technical Areas must be covered in blue carpet of the same type used for the gaming areas. On the opposite sides of these areas an opening 1m wide in the Safety Boundary must exist, and a low slope ramp must connect this opening to the ground floor level to allow robots to move smoothly into and out of the TTAs (see drawing in RC-1.0). The Team Technical Area is at the defensive side of the first half, and does not change afterwards.

FL 1.3 The Goal Area

A goal area is defined at each end of the field as follows:

Two lines are drawn at right angles to the goal line, 5.5m (6yds) from the inside of each goalpost. These lines extend into the field of play for a distance of 5.5m (6yds) and are joined by a line drawn parallel with the goal line. The area bounded by these lines and the goal line is the goal area.

	**RoboCup Changes and Comments**
RC-1.3: Goal Area	For RoboCup, replace "*5.5m*" by "**0.75m**".

FL 1.4 The Penalty Area

A penalty area is defined at each end of the field as follows:

1. Two lines are drawn at right angles to the goal line, 16.5m (18yds) from the inside of each goalpost. These lines extend into the field of play for a distance of 16.5m (18yds) and are joined by a line drawn parallel with the goal line. The area bounded by these lines and the goal line is the penalty area.
2. Within each penalty area a penalty mark is made 11m (12yds) from the midpoint between the goalposts and equidistant to them. An arc of a circle with a radius of 9.15m (10yds) from each penalty mark is drawn outside the penalty area.

	**RoboCup Changes and Comments**
RC-1.4: Penalty Area	For RoboCup, replace "*16.5m*" by "**2.25m**", and "*11m*" by "**3.6m**". In RoboCup, the penalty spot is outside the penalty area. No circle arc is used in RoboCup.

FL 1.5 Flag-posts

A flag-post, not less than 1.5m (5ft) high, with a non-pointed top and a flag is placed at each corner. flag posts may also be placed at each end of the halfway line, not less than 1m (1yd) outside the touch line.

	**RoboCup Changes and Comments**
RC-1.5: Flag-posts	No flag-posts are currently used in RoboCup.

FL 1.6 The Corner Arc

A quarter circle line with a radius of 1m (1yd) from each corner flag-post is drawn inside the field of play.

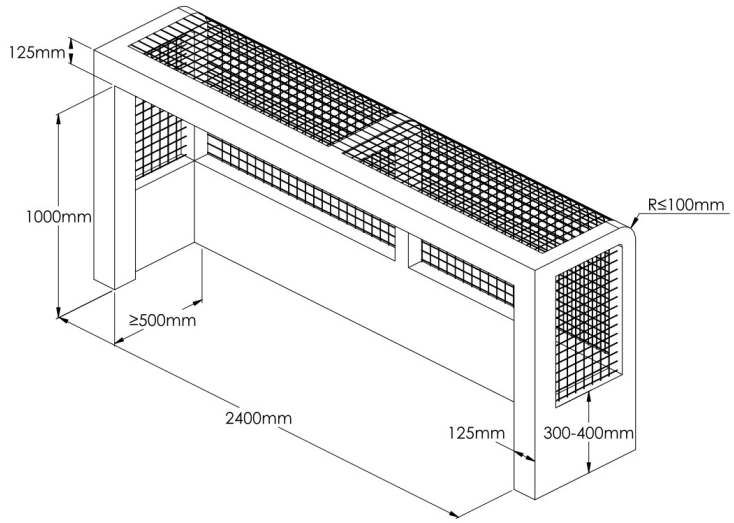
	**RoboCup Changes and Comments**
RC-1.6: Corner Arc	For RoboCup, replace "*1m*" with "**0.75m**".

FL 1.7 Goals

Goals must be placed on the center of each goal line. They consist of two upright posts equidistant from the corner flag-posts and joined at the top by a horizontal crossbar. The distance between the posts is 7.32m (8yds) and the distance from the lower edge of the crossbar to the ground is 2.44m (8ft).

Both goalposts and the crossbar have the same width and depth which do not exceed 12.5cm (5ins). The goal lines are the same width as that of the goalposts and the crossbar. Nets may be attached to the goals and the ground behind the goal, provided that they are properly supported and do not interfere with the goalkeeper.

The goalposts and crossbars must be white.

RoboCup	**RoboCup Changes and Comments**
RC-1.7: Goals	For RoboCup, replace "*7.32m*" with "**2.4m**" and "*2.44m*" with "**1m**". A net is spawn between the crossbar and goal posts to the safety boundary of the field. To avoid direct contact of the net with parts of the robots (wheels, kicking device, etc.), the lower part of the net must be covered over a height between 30 and 40cm as a safety zone. This safety zone has to be done by the local organizer and may vary in each tournament. The inside depth of the goal is at least 0.5m (see image bellow). The goalposts the crossbar and the lower inside covered part are painted white. See also COMPETITION RULE 4 for color samples. In order to prevent the keeper getting stuck with the upper parts of the nets, the radius of the arc at the upper-back region of the goal has to be below 100mm. **Local Tournaments** If a LOC can only provide a field of 18m × 12m on a Local Tournament, the goal width must be **2m**.
	

FL 1.8 Safety

Goals must be anchored securely to the ground. Portable goals may only be used if they satisfy this requirement.

Decisions of the International F.A. Board

Decision 1: If the crossbar becomes displaced or broken, play is stopped until it has been repaired or replaced in position. If a repair is not possible, the match is abandoned. The use of a rope to replace the crossbar is not permitted. If the crossbar can be repaired, the match is restarted with a dropped ball at the place where the ball was located when play was stopped (see FIFA LAW 8).

Decision 2: Goalposts and crossbars must be made of wood, metal or other approved material. Their shape may be square, rectangular, round or elliptical and they must not be dangerous to players.

Decision 3: No kind of commercial advertising, whether real or virtual, is permitted on the field of play and field equipment (including the goal nets and the areas they enclose) from the time the teams enter the field of play until they have left it at half-time and from the time the teams re-enter the field of play until the end of the match. In particular, no advertising material of any kind may be displayed on goals, nets, flag-posts or their flags. No extraneous equipment (cameras, microphones, etc.) may be attached to these items.

Decision 4: The reproduction, whether real or virtual, of representative logos or emblems of FIFA, confederations, national associations, leagues, clubs or other bodies, is forbidden on the field of play and field equipment (including the goal nets and the areas they enclose) during playing time, as described in Decision 3.

Decision 5: A mark may be made off the field of play, 9.15 meters (10 yds) from the corner arc and at right angles to the goal lines to ensure that this distance is observed when a corner kick is being taken.

	**RoboCup Changes and Comments**
RC-Decision 5:	FIFA Decision 5 applies with 2m and 3m distances in RoboCup. The organization will provide a 3m long light wooden bar, with a visible mark at 2m from one of the extremities. This can used by the referees to check the above distances.

FIFA LAW 2 – The Ball

FL 2.1 Qualities and Measurements

The ball is

- spherical,
- made of leather or other suitable material,
- of a circumference of not more than 70cm (28ins) and not less than 68cm (27ins),
- not more than 450g (16oz) in weight and not less than 410g (14oz) at the start of the match,
- of a pressure equal to 0.6–1.1 atmosphere (600 - 1100g/cm^2) at sea level (8.5lbs/sqin – 15.6 lbs/sqin).

	**RoboCup Changes and Comments**
RC-2.1: Qualities and Measurements	Each team has to be able to play with a defined FIFA standard size 5 football at any time. The official tournament ball will be announced at least one month before the tournament and won't mainly consist of the colors black, white or green (except in the technical challenges). The vision system of the robots has to be robust enough to handle any above mentioned ball without recalibration. The ball should not be worn down too much and both team leaders have to find an agreement before a match about which of the official balls they want to use. Else the referee decides about the ball.

FL 2.2 Replacement of a Defective Ball

If the ball bursts or becomes defective during the course of a match:

- The match is stopped.
- The match is restarted by dropping the replacement ball at the place where the first ball became defective (see FIFA LAW 8).

If the ball bursts or becomes defective whilst not in play at a kick-off, goal kick, corner kick, free kick, penalty kick or throw-in:

- The match is restarted accordingly.

The ball may not be changed during the match without the authority of the referee.

Decisions of the International F.A. Board

Decision 1: In competition matches, only footballs which meet the minimum technical requirements stipulated in FIFA LAW 2) are permitted for use. In FIFA competition matches, and in competition matches organized under the auspices of the confederations, acceptance of a football for use is conditional upon the football bearing one of the following three designations: The official "FIFA APPROVED" logo, or the official "FIFA INSPECTED" logo, or the reference "INTERNATIONAL MATCHBALL STANDARD". Such a designation on a football indicates that it has been tested officially and found to be in compliance with specific technical requirements, different for each category and additional to the minimum specifications stipulated in FIFA LAW 2). The list of the additional requirements specific to each of the respective categories must be approved by the International F.A. Board. The institutes conducting the tests are subject to the approval of FIFA. National association competitions may require the use of balls bearing any one of these three designations. In all other matches the ball used must satisfy the requirements of FIFA LAW 2.

Decision 2: In FIFA competition matches and in competition matches organized under the auspices of the confederations and national associations, no kind of commercial advertising on the ball is permitted, except for the emblem of the competition, the competition organizer and the authorized trademark of the manufacturer. The competition regulations may restrict the size and number of such markings.

	**RoboCup Changes and Comments**
RC-Decision 2:	The organizing committee of a tournament is responsible for approving the balls to be used, including any kind of advertisement, logo, or emblem on the ball.

FIFA LAW 3 – The Number of Players

FL 3.1 Players

A match is played by two teams, each consisting of not more than eleven players, one of whom is the goalkeeper. A match may not start if either team consists of fewer than seven players.

	**RoboCup Changes and Comments**
RC-3.1: Players	A match is played by two teams, each consisting of not more than five players, one of whom is the goalkeeper. A match may not start if either team consists of fewer than two players. If the number of players of a team falls down to two during a match, then the match will still continue. However, if the number of players of a team falls to less than two, the match will be ended and competition rule 3.7 will be applied.
RC-3.1.1: Incapable Players	Players not capable of play, e.g. players not able to move, or players with defective or malfunctioning sensing and/or actuating systems, are not permitted to participate in the game. It is up to the referee to judge whether a player is capable of play. In case of doubt, during a stoppage, the referee will ask the RefBox assistant to send a specific command indicating the team and robot number. This robot should then react by rotating left over its center 15^{o} to the left, followed by a similar movement to the right for 30^{o} and finally rotating back to its original position

FL 3.2 Official Competitions

Up to a maximum of three substitutes may be used in any match played in an official competition organized under the auspices of FIFA, the confederations or the national associations. The rules of the competition must state how many substitutes may be nominated, from three up to a maximum of seven.

	**RoboCup Changes and Comments**
RC-3.2: Official Competitions	Currently, in RoboCup MSL, only autonomous substitutions, as further described in RC-3.5, are allowed. Furthermore, only a maximum of three substitutions may be used throughout the entire game (including the situations where extra time applies). For each substitution, only one of the robots on the game field may be nominated. However, a player who has been replaced or substituted, can play again in the match, either through another substitution or after the end of a repair period if the number of team mate players on the field is less than five.

FL 3.3 Other Matches

In other matches, up to five substitutes may be used, provided that:

- The teams concerned reach agreement on a maximum number.
- The referee is informed before the match.

If the referee is not informed, or if no agreement is reached before the start of the match, no more than three substitutes are allowed.

	**RoboCup Changes and Comments**
RC-3.3: Other Matches	In other RoboCup matches, outside official competitions, up to a maximum of five autonomous substitutions may be used throughout the game. In these matches, the remaining rules established in RC-3.2 still apply.

FL 3.4 All Matches

In all matches the names of the substitutes must be given to the referee prior to the start of the match. Substitutes not so named may not take part in the match.

	**RoboCup Changes and Comments**
RC-3.4: All Matches	In all RoboCup matches the number of the robot nominated for substitution must be provided to the referee during a game stoppage and prior to re-start. Robots not numbered may not take part in the match (RC-4.2.4). Changing numbers between robots either in the field or in the Team Technical Area is not allowed. Once the team has received an acknowledge from the referee to perform an autonomous substitution, the number of autonomous substitutions for that team will be incremented (RC-3.2 and RC-3.3) regardless of their ability to actually perform that substitution.

FL 3.5 Substitution Procedure

To replace a player by a substitute, the following conditions must be observed:

- The referee is informed before any proposed substitution is made.
- A substitute only enters the field of play after the player being replaced has left and after receiving a signal from the referee.
- A substitute only enters the field of play at the halfway line and during a stoppage in the match.
- A substitution is completed when a substitute enters the field of play.
- From that moment, the substitute becomes a player and the player he has replaced ceases to be a player.
- A player who has been replaced takes no further part in the match.
- All substitutes are subject to the authority and jurisdiction of the referee, whether called upon to play or not.

	**RoboCup Changes and Comments**
RC-3.5: Substitution Procedure	To replace a player robot by a substitute, the following procedure must be observed: • The referee must be informed about all desired substitutions directly after a game stop. A human team member (defined at RC-4.5.1) will show one or more numbered signs to the referees, such as a substitution paddle as used in volleyball, indicating each robot in the field which should be substituted during the next (or current) game stoppage. As an autonomous procedure is required, from the moment of approval by the referee, no team member is allowed to stay in the Team Technical Area at a distance closer than 1m to the robot or robots that are going to substitute the ones being replaced. Any doubt of the referee of (manual) interference is considered as a non-autonomous substitution. A repair will be called, still leading to an increment in the number of substitutions. • During the game stoppage, the assistant referee (Referee Box) will send a message (Go to the Team Technical Area) to the coach-pc of both teams. • After receiving this command, all players that are being substituted should go autonomously to the Team Technical Area in less than 15 seconds and without hitting other robots, goals or boundary area. All other robots on the field remain stopped. Once the robot(s) reach(es) the Team Technical Area (i.e., the robot is completely inside the Team Technical Area as defined in RC-1.1), human team members are allowed to be in contact with the substituted robot. • From that moment, the player which has reached the Team Technical Area ceases to be a player until the next substitution occurs or until the next stoppage situation if a repair period is finished and the number of teammate players on the field is less than five. • The substituting robot can only enter the field of play autonomously, after the player being replaced has left the green playing area and entered the Team Technical Area. Once being able to enter the field, the substituting robot can move directly to any place in the green area, close to the side line - but outside of it - and stop there • From that moment, the substitute becomes a player. • The robot may then enter the area of play as soon as the RefBox sends the next command. Team members are allowed to fully use the Team Technical Area again. • A substitution is completed when a substitute enters the field of play by the side line. If the player robot or the substitute don't move, if the total process takes more than 20 seconds, regardless of the number of substitutions, or if a robot crashes during this process, rule RC-4.5.1 will be called, and the offending robot(s) in the field must be taken out to the technical area for repair. Based on the strength of the crash, the referee may also decide to show the robot a yellow or even a red card. • A player who has been replaced can play later again in the match either by another autonomous substitution or after the end of a repair period. • All substitutions are subject to the authority and jurisdiction of the referee, whether called upon to play or not.

FL 3.6 Changing the Goalkeeper

Any of the other players may change places with the goalkeeper, provided that:

- The referee is informed before the change is made.
- The change is made during a stoppage in the match.

Any other robots can substitute with the Goalkeeper robot, by observing the RC-3.5, RC-4.2.0, RC-4.4 and all other related rules.

	**RoboCup Changes and Comments**
RC-3.6: Changing the Goalkeeper	Any other robot can substitute the Goalkeeper robot in correspondence with RC-3.5, RC-4.2.0, RC-4.4 and all other related rules.

FL 3.7 Infringements/Sanctions

If a substitute enters the field of play without the referee's permission:

- Play is stopped.
- The substitute is cautioned, shown the yellow card and required to leave the field of play.
- Play is restarted with a dropped ball at the place it was located when play was stopped (see FIFA LAW 8).

If a player changes places with the goalkeeper without the referee's permission before the change is made:

- Play continues.
- The players concerned are cautioned and shown the yellow card when the ball is next out of play.

For any other infringements of this Law:

- The players concerned are cautioned and shown the yellow card.

FL 3.8 Restart of Play

If play is stopped by the referee to administer a caution:

- The match is restarted by an indirect free kick, to be taken by a player of the opposing team from the place where the ball was located when play was stopped (see FIFA LAW 8).

FL 3.9 Players and Substitutes Sent Off

A player who has been sent off before the kick-off may be replaced only by one of the named substitutes. A named substitute who has been sent off, either before the kick-off or after play has started, may not be replaced.

FL 3.10 Decisions of the International F.A. Board

Decision 1: Subject to the overriding conditions of FIFA LAW 3, the minimum number of players in a team is left to the discretion of national associations. The Board is of the opinion, however, that a match should not continue if there are fewer than seven players in either team.

Decision 2: The coach may convey tactical instructions to the players during the match. He and the other officials must remain within the confines of the technical area, where such an area is provided, and they must behave in a responsible manner.

	**RoboCup Changes and Comments**
RC-Decision 2:	RoboCup players must play autonomously. Coaching and any kind of human interference with robots, with or without technical means, is not allowed, except when according to the ruling RC-Decision 2.1 or where otherwise specified in the Laws. Human interference is only allowed for substitutes and robots outside of the playground, and only if the robots are inactive, in particular, if they do not send any kind of signals, including wireless communications.

	**RoboCup Changes and Comments**
RC-Decision 2.1:	High level human voice coaching is allowed and has to comply with the following rules: • voice coaching can be provided through dedicated headpiece microphones connected to the team's base station; • coaching is only allowed from only one team member, known in advance; • the microphone must be muted when not in use. It must be easily visually verifiable when the microphone is muted. No microphone will be provided by the organization; • voice commands may only be issued when the game is stopped; • voice commands can only be issued in English; • any voice command received by the base station must be sent verbatim as an `MSLEVENT` to the RefBox Human voice coaching is intended to allow team high level coaching and shoud not be used in any way to immediately influence the game (e.g., "shoot", "pass"). If referees believe that the spirit of the rule is not respected, they can forbid voice coaching for a team for the rest of the game. After that, the team has to obtain explicit TC approval to use it in future matches during the competition.

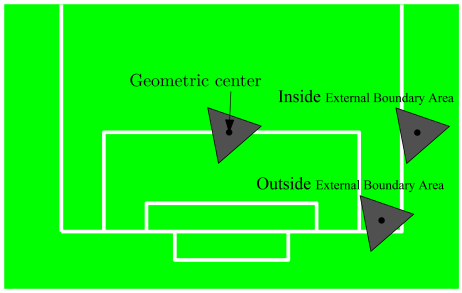
FIFA LAW 4 – The Players' Equipment

	**RoboCup Changes and Comments**
RC-4.0.1: Design Guideline	Robots for playing soccer must be designed such that they are **both robust and safe**. Both terms are subsequently explained. To support the TC during the verification of the robot size and of the ball manipulation devices, the adequate measurements (e.g. construction plans, etc.) of the robots have to be published before the tournaments. This is regulated in more detail during the qualification process of a tournament.

FL 4.1 Safety

A player must not use equipment or wear anything which is dangerous to himself or another player (including any kind of jewellery).

	**RoboCup Changes and Comments**
RC-4.1: Safety	Robot soccer players must be built such that they are **safe**. Safe means that robots do not damage other robots or any objects of the playground, or pose a threat to the audience, or to the referees, or to human team members. In particular, **the design of the robots should ensure that "Fouls and Misconduct" (FIFA LAW 12)** are avoided. Each robot must have a **vertically continuous** safety border, at least 1 cm thick and 6 cm high, made out of soft material, which is added around the bottom of the robot. This soft material layer should be supported on the back over its complete height. Borders made of independent non connected pieces, or that only partially covers the outer limits of the robot (with the exception of the natural openings such as the ball engaging area), are not allowed and will be checked upon during technical verifications or at any time during a game by the referee. This border must be well attached to the robot and may not fall down, partially or totally, during the game. If such a thing happens, the robot must be removed from the field for repair. Anyone is allowed to take whatever action that seems necessary to prevent a robot from causing urgent danger. This includes lifting the robot and/or switching it off. Teams must provide an emergency stop button on their robot that interrupts all actuation.
RC-4.1.1: Jamming	Robots must be designed and programmed such that they try to avoid interference concerning the operation of sensor systems and/or communication devices. The use of particular equipment which may cause interference of communication and/or sensors must be reported to the league organizing committee of a tournament and eventually negotiated between two teams before a match. In case teams cannot come to an agreement, the TC decides. If a team uses communications and sensors other than those previously declared to the tournament committee and/or the opponent, the game may be forfeited, and the league organizing committee may exclude the robots from further participation.

	**RoboCup Changes and Comments**
RC-4.1.2: External Boundary Area	All robots must be able to detect those situations where they are currently placed outside the external line of the field of play (inside the external 1m wide boundary area). Robots may not, either intentionally or not, crash against the field Safety Boundary. A robot is considered to have crashed against the field Safety Boundary if its speed is high enough to potentially damage this boundary(even if the boundary is strong enough to hold the robot). In any case, if it is clear that the robot is not making an attempt to stop, and hits the Safety Boundary even at low speed, this is considered to be a crash. It is up to the referee to judge those situations and call a free kick against the offending team whenever he considers a crash has occurred. Based on the strength of the crash, the referee may also decide to show the robot that crashed against the boundary a yellow or even a red card. It is **required** that whenever a robot, or set of robots, are chasing the ball, they stop their movement as soon as they have detected that the ball is outside the field of game. NOTE: If a robot is pushed against the Safety Boundary by an opponent robot, a pushing fault will be called instead. If a robot gains strategic advantage by positioning itself inside the the external boundary area, a freekick will be called. A robot is considered to be inside the external boundary area if the projection of the robot's geometric center on the field lies beyond the side or goal line (example in figure below). 
RC-4.1.3: Exclusion	Robots that violate the above conditions, in particular if they threaten to seriously damage opponents or pose a threat to the audience and/or referees and/or human team members, may be excluded from play in a tournament by the league organizing committee.
RC-4.1.4: Goals	Robots may not, either intentionally or not, crash against the goals. A robot is considered to have crashed against the goal if its speed is high enough to potentially damage it (even if the goal is strong enough to hold the robot). In any case, if it is clear that the robot is not making an attempt to stop and hits a goal even at low speed, this is considered to be a crash. This also applies to goalkeeper players that recurrently touch and push the goal. It is up to the referee to judge those situations and call a free kick against the offending team whenever he considers a crash has occurred.

FL 4.2 Basic Equipment

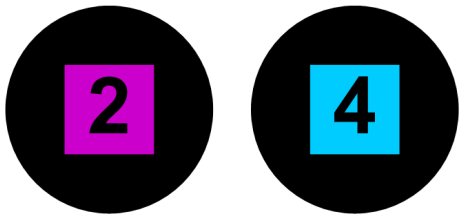
The basic compulsory equipment of a player is:

- a jersey or shirt,
- shorts - if thermal undershorts are worn, they are of the same main color as the shorts,
- stockings,
- shin-guards,

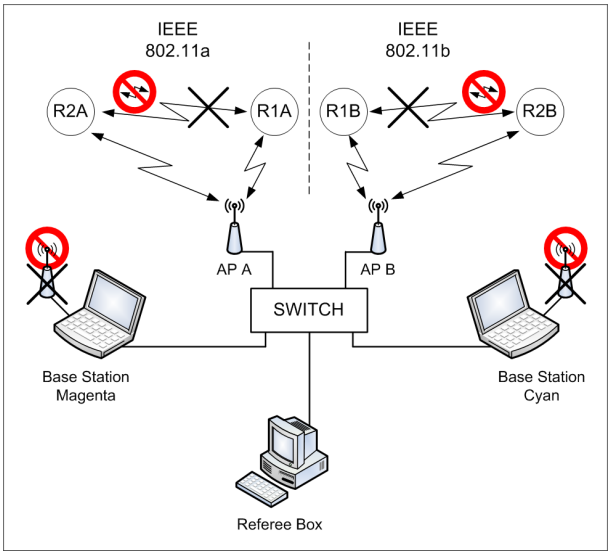
- footwear.

	**RoboCup Changes and Comments**
RC-4.2.0: Robot Size	The size of each robot player must obey the following constraints: 1. Each robot must possess a configuration of itself and its actuators, where the projection of the robot's shape onto the floor fits into a square of size at least 30cm × 30cm and at most 52cm × 52cm. 2. The usual field player has to keep at any time the size limit of 52cm × 52cm. 3. Within the penalty area, the goalie is allowed to increase its size instantaneously (at most 1 second) if the goal is endangered by an approaching ball. The extension can take up at most 920 cm^2 from any side, calculated as the convex hull of the extension. This is backwards compatible with the rules of RoboCup 2022 and before, allowing older goalkeepers without modification: *The goalkeeper can increase its size up to a square of 60cm × 60cm width or 90cm height.* The goalkeeper must reduce its size autonomously, and is only allowed to increase its size again after a pause of 4 seconds and having completely reduced his size to the normal state before the increase. Additionally, it is only allowed to increase its size instantaneously in one direction. Any dimension extending can only be applied exclusively, particularly extending arms can not be activated at the same time as the special goalkeeper ball catch hardware (see RC-12.0.2). The keeper is allowed to move outside the penalty area, but increasing its size outside the penalty area is considered as a violation of the robot-size. In this case, a free-kick will be awarded to the opponent. If the extension of the goalkeeper damages the goal or field, the goalkeeper has to be removed for repair, according to RC-4.5.1. 4. The robot's height must be at least 40 cm and at most 80 cm. 5. The field players may never exceed the 80 cm height limit. 6. Above the height of 60cm measured from the ground, all the elements of the robots (with the exception of the goalie) must fit within a cylinder with a diameter of 25cm. 7. The size of the robots will be checked before the tournament by the TC. If a robot doesn't match the described limits it will be excluded from the competition.
RC-4.2.1: Robot Shape	Any shape is allowed as long as the size restrictions are not violated. Robots may exhibit concavities in their shape or may dynamically change shape, provided that the Laws concerning "Fouls and Misconduct" (FIFA LAW 12) are not violated.
RC-4.2.2: Robot Weight	The maximum weight of a robot is 40 kg.

	**RoboCup Changes and Comments**
RC-4.2.3: Robot Colours	The base color of a robot's body must be black. The paint or used material must be **matte** in order to minimize reflectivity. **Note 1:** This law does not mean that your robot must be completely black; for example, one cannot paint the lens of a camera. However, every team is expected to try hard to hide non-black parts of the robot as much as possible, especially parts that have colors used for the ball or the field of play. **Note 2:** Teams should avoid using any kind of shiny material for robot surfaces. The league committee may exclude robots that do not conform with colouring laws.
RC-4.2.4: Robot Markers	A robot must have markings in order to be recognized by other robots and to be distinguished by the referee. Each robot must carry color markers, number markers, and top markers. Robots not carrying all markers **are not eligible to play**. The use of active markers (for example, LEDs or other types of screens) is only allowed in case this is explicitly approved by the opponent team before the commencement of the game. In all other cases, teams must provide passive markers in order to avoid sensor interference. Markers should be static. For example, a marker can only contain one image, and its contents, saturation nor intensity are allowed to change during a match. If at any time the robot markers are no longer fulfilling their function (e.g. are not visible, fail or become detached), the robot needs to be taken out of the field for repair.
RC-4.2.4.1: Colour Markers	Colour markers should be designed as follows: • Above 30cm, color markers must be present and visible from all sides. • A color marker can be any shape. • The height and width of a color marker must be greater than or equal to 10 cm in any direction. • The markers must be of a saturated color. All colors are allowed except for black, white, green and the color of the ball (which might be different in every competition). It is the responsibility of team leaders to make sure color markers are at significant distance from the reserved colors black, green, white and the color of the ball. The MSL TC can request to build new markers on site, if the teams color markers are too dark, too light, or too close to the color of the ball or the field. • Each team must have two distinct sets of color markers available. Color markers on the robot should be swappable. • See also COMPETITION RULE 4 for colour examples.

	RoboCup Changes and Comments
RC-4.2.4.2: Number Markers	A number marking should be designed as follows: • Each robot must carry a number (consisting of two digits at most), in black digits of height no smaller than 8 cm. • The number will be fixed on the color markers and must at least be visible from all four major sides (front, back, left and right) of the robot. • The number 1 is reserved for goal keepers. • The number marking must be easily visible for the referee, other humans and robots from all sides. • The number markers of the robots will be checked before the tournament by the TC. If the markers do not comply with the above rules, the team will be requested to build new number markers on site.
RC-4.2.4.3: Top Markers	Each robot must carry a top marker as follows (example in figure below): • The top marker can have the color also used in RC-4.2.4.1, be black, or a combination of black with the team color. • A robot's number marker of at least 8 cm in height must be clearly visible. 

	**RoboCup Changes and Comments**
RC-4.2.5: Communications	Communication between the robots of a team using wireless links is allowed according to the following rules. Communication between the robots and one remote computer system (herein after referred as Base Station) is also allowed, provided that human interference is excluded. Robots may receive data or commands from this remote computer, as long as these does not include any further information gained by non-robot sensors (e.g. position of the robot itself, or teammates, or opponents, or the ball on the field). It is especially allowed to fuse data on the external computer, if that data is gained only by robots. Wireless communication equipment satisfying IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n specifications are allowed. Use of any other kind of wireless communications using these or other frequencies is explicitly forbidden. All communications between robots, as well as between robots and the Base Station, must be established through one of the two Access Points available at the field of game (usually in 'a' or in 'b' mode, but 'g' and 'n' may optionally be available), and provided by the organization. Use of ad hoc wireless networking is strictly forbidden. Teams may use either unicast or multicast wireless communication modes. Use of broadcast is strictly forbidden. Unicast and IPv4 multicast IP addresses are defined for each team in these rules (see bellow). Teams may not use any IP addresses other than those assigned to them. Although robots may send arbitrary kinds and amounts of data between each other and the Base Station, bandwidth restrictions will apply in order to assure a fair game. All competing teams should have the same network limits, whichever IEEE 802.11 mode is being used. This way, the slower mode (IEEE 802.11b specification) is the one that actually limits the amount of data that can be transmitted. Each team is then allowed to use, at most, 20% of the bandwidth provided by the IEEE 802.11b Access Point. Therefore, 2.2 Megabits/second is the actual maximum bit rate that can be used by any team during the tournament. Apart from the communication equipment placed in the robots, no other team computers or equipment may use any form of wireless communication. In particular, it is mandatory that the team's Base Station Computer has its wireless support turned off. No Access Points, other than those provided by the organization, and the ones used by the robots that are currently playing may be turned on during the tournament games. Each team has to provide, together with other team qualification materials, a list of all MAC addresses they intend to use during the tournament, with explicit indication of those that will be used for wireless communication and its type: robots or development computers. All other MAC addresses will blocked to connect to the field Access Points. Violating the communication-protocol leads to a disqualification of the match.

	RoboCup Changes and Comments
RC-4.2.5: Communications	**Competition setup** Each field of the competition will be equipped with the following base elements provided by the organization: • Two Access Points. One working in IEEE 802.11a and other working in IEEE 802.11b. These Access Points may or may not be included in a single piece of equipment. • If none of the participating teams requires IEEE 802.11b (reported along with the qualification materials), this Access Point will be turned off. • One computer for running the Referee Box software • Two LCD screens for Base Station visualization. As defined elsewhere, Base Station laptops must have their covers closed during the entire game. Both Access Points will connect to a wired network by means of one or two switches. Both the Referee Box and the team Base Stations must also be connected by cable to the wired network. Each team has to design their software in such a way that it is possible for them to use only one Base Station to manage a game. Commands from the Referee Box will be sent to the team's Base Station using the wired connection. It is the team responsibility to re-send these commands to their robots on the field. Network settings, during the competition, will be as follows: • Password for connecting to the APs may be turned on. If that's the case it will be disclosed to the teams at the beginning of the tournament. • WEP encryption is turned off. • Broadcast of SSID is turned off. • Subnet mask normal PC: 255.255.255.0. • Subnet mask of a PC connected to the RefBox: 255.255.0.0. • Access Point Beacon Interval should be set to 20-30. • Access Point DTIM Interval should be set to 2-3. • Access Point power save mode is disabled. 

	**RoboCup Changes and Comments**
RC-4.2.5: Communications	**Technical verifications and sanctions** During technical verifications teams must be prepared to demonstrate and explain their communication setup and software to the MSL Technical Committee. This will include network configuration and bandwidth usage. Furthermore, team robots must be placed in the field and respond to basic Referee Box commands. The Network Monitor software will be used to verify that the team communication setup is in accordance to the rules. Teams that fail to comply with the current communications rules will be asked by the Technical Committee to re-adjust their software and setup in order to correct the detected incompatibilities. If the team fails a second technical verification, it may be excluded from playing in the tournament by the league organizing committee. Power emitted by any of the team's robots wireless equipment must be limited in order to ensure that all teams have the same conditions for wireless communications. To ensure that, during technical verifications, a device to measure RSSI (expressed in dBm) with an external directional antenna (e.g., a Fluke Wi-Fi AirCheck(*Trade Mark*)) is used during technical verifications. Measurements are performed under the following conditions: • team robots will be placed along the mid line and connected to the field router; • the measurement equipment will be placed over the goal line with the antenna pointed towards the robots (11 meter distance); • the maximum received power may not exceed -45dBm. Teams failing to comply with this limit will be requested to re-adjust the power of their WiFi equipment. Only after that they will be considered able to enter the competition. If, during or after a match, the Network Monitor shows a clear violation of the rules either by the playing teams, or by any other MSL teams in the neighbourhood, the reported offending team will be awarded a warning by the technical committee. A second warning, issued to the same team during the tournament, may lead to the team exclusion, by decision of the league organizing committee, under recommendation of the technical committee.
RC-4.2.6: Sensing Systems	Any sensing system is allowed as long as the following constraints are met: 1. All parts of the sensing system (i.e .the actual sensing device and, if applicable, a signal emitting device) must be on the robots. 2. There may be no manipulation of the environment, such as placing specific markers as landmarks.

	**RoboCup Changes and Comments**
RC-4.2.7: Ball Handling Mechanisms	Robots may have special devices for ball handling. Ball handling devices must be designed such that they are safe and non-destructive for the ball. It is up to the referee to evaluate if this situation occurs. In such a case, the referee should write down a note on the game sheet indicating the team name that violates this rule. More than two such comments may lead to team disqualification. This decision will always be taken by the Technical Committee. The robot's use of ball handling devices must comply with the Laws set forth in "Fouls and Misconduct" (FIFA LAW 12).

FL 4.3 Shin-guards

- are covered entirely by the stockings.
- are made of a suitable material (rubber, plastic, or similar substances).
- provide a reasonable degree of protection.

	**RoboCup Changes and Comments**
RC-4.3.1: Robustness	Robot soccer players must be built such that they are **robust**. Robust means that the physical integrity of the robot is not endangered by incidental, accidental, or intentional collisions with the ball or objects of the field or other robots. The robot's sensing systems and software should be able to handle potentially significant levels of noise caused by other sources, such as other robots, game officials, team members, spectators, or the media. Robots are allowed to kick a ball upward with no penalty. This means that the robots should be build strong enough to tolerate it.

FL 4.4 Goalkeepers

- wear colors which distinguish them from the other players, the referee and the assistant referees

	**RoboCup Changes and Comments**
RC-4.4: Goalkeepers	Goalkeepers must obey the same colouring and marker constraints as the other robots in their team. The number on the top marker must indicate that a player is a goal keeper. If a normal player replaces the goal keeper at the beginning of the game, this player must exhibit the number 1 in order to clarify its function in the game. If the replacement occurs during the game the replacing goal keeper does not have to wear the side color, number marker or top marker of the regular goal keeper. If a goal keeper is removed from the field during a game stoppage, then, just after the ending of the stoppage, it can be automatically replaced by one of the field players. The robot that enters the goal area first, automatically become the new goalie, and stays as that until number 1 player re-enters the field or until it is removed from the field itself. If the number 1 player later re-enters the game, the replacing goalie must resume its role as field player.

FL 4.5 Infringements/Sanctions

For any infringement of this Law:

- Play need not be stopped.
- The player at fault is instructed by the referee to leave the field of play to correct his equipment.
- The player leaves the field of play when the ball next ceases to be in play, unless he has already corrected his equipment.
- Any player required to leave the field of play to correct his equipment does not re-enter without the referee's permission.
- The referee checks that the player's equipment is correct before allowing him to re-enter the field of play.
- The player is only allowed to re-enter the field of play when the ball is out of play.

A player who has been required to leave the field of play because of an infringement of this Law and who enters (or re-enters) the field of play without the referee's permission is cautioned and shown the yellow card.

	**RoboCup Changes and Comments**
RC-4.5.1: Repair of Robots	Team leaders may ask the referee for permission to remove a player from the field, if there is a problem with the player's hardware and/or software. If the referee gives permission to remove a player, one human team member, who must be properly dressed and who has been identified to the referee before the start of the game, may enter the field and remove a robot only during a game stoppage. Checking that the player's equipment is correct may also be done by assistant referees. When a player is removed from the field, the referee will signal the person at the RefBox to register this in the RefBox. The person at the RefBox will press a button for the team which indicates that a player is removed. After 20s the RefBox will automatically send a signal over the network to signal that a robot can enter the field again during the next game stoppage. The RefBox will show when the 20s period is over. If a robot re-enters the field before the 20s are passed or when the game is not stopped, the opponent team will be awarded a free kick executed on the kick-off point. The robot that illegally entered the field has to be removed again and the 20s timer will be restarted. After a player has been repaired or a player's equipment has been corrected, the player is allowed to enter the field. This can only happen during a game stoppage and after having received a corresponding signal from the RefBox and approval from the referee. It is explicitly allowed to add a different robot than the one that was taken out, assuming all other steps laid out in this rule are followed.

FL 4.6 Restart of Play

If play is stopped by the referee to administer a caution:

- the match is restarted by an indirect free kick taken by a player of the opposing side, from the place where the ball was located when the referee stopped the match.

FIFA LAW 5 – The Referee

FL 5.1 The Authority of the Referee

Each match is controlled by a referee who has full authority to enforce the Laws of the Game in connection with the match to which he has been appointed.

FL 5.2 Powers and Duties

The Referee:

- enforces the Laws of the Game.
- controls the match in co-operation with the assistant referees and, where applicable, with the fourth official.
- ensures that the ball meets the requirements of FIFA LAW 2.
- ensures that the players' equipment meets the requirements of FIFA LAW 4.
- acts as timekeeper and keeps a record of the match.
- stops, suspends or terminates the match, at his discretion, for any infringements of the Laws.
- stops, suspends or terminates the match because of outside interference of any kind.
- stops the match if, in his opinion, a player is seriously injured and ensures that he is removed from the field of play.
- allows play to continue until the ball is out of play if a player is, in his opinion, only slightly injured.
- ensures that any player bleeding from a wound leaves the field of play. The player may only return on receiving a signal from the referee, who must be satisfied that the bleeding has stopped.
- allows play to continue when the team against which an offence has been committed will benefit from such an advantage and penalizes the original offence if the anticipated advantage does not ensue at that time.
- punishes the more serious offence when a player commits more than one offence at the same time.
- takes disciplinary action against players guilty of cautionable and sending-off offences. He is not obliged to take this action immediately but must do so when the ball next goes out of play.
- takes action against team officials who fail to conduct themselves in a responsible manner and may at his discretion, expel them from the field of play and its immediate surrounds.
- acts on the advice of assistant referees regarding incidents which he has not seen.
- ensures that no unauthorized persons enter the field of play.
- restarts the match after it has been stopped.
- provides the appropriate authorities with a match report which includes information on any disciplinary action taken against players, and/or team officials and any other incidents which occurred before, during or after the match.

	**RoboCup Changes and Comments**
RC-5.3: Powers and Duties	In RoboCup, some referee duties like time keeping and keeping a record of the match may be delegated to one of the assistant referees.
RC-5.3.1: Referee Box	In RoboCup, assisting technology is used to support the referee, in particular for conveying referee decisions to robot players and for maintaining a record of the game. Such assisting technology includes a referee box and possibly other sorts of technology. In particular, whenever the Laws of the Game specify that the referee is giving a signal, the referee box protocol specifies the communication of one or more messages to the team remote computer system. Operation of the referee box is delegated to an assistant referee.
RC-5.3.2: Permission to stop the robots	Whenever a robot shows a behaviour which is clearly dangerous either to the opponent robots or to spectators, a single human team-member is allowed to enter the field without permission of the referee to stop the robot by means of its mandatory emergency stop button. If a robot is stopped in this way, the game is also stopped by the referee and resumed with a free-kick for the other team. This free-kick will be taken from the position where the ball was when the robot was stopped, or from one of the closest restart points.

FL 5.3 Decisions of the Referee

The decisions of the referee regarding facts connected with play are final. The referee may only change a decision on realizing that it is incorrect or, at his discretion, on the advice of an assistant referee, provided that he has not restarted play.

Decisions of the International F.A. Board

Decision 1: A referee (or where applicable, an assistant referee or fourth official) is not held liable for:

- any kind of injury suffered by a player, official or spectator,
- any damage to property of any kind,
- any other loss suffered by any individual, club, company, association or other body, which is due or which may be due to any decision which he may take under the terms of the Laws of the Game or in respect of the normal procedures required to hold, play and control a match.

This may include:

- a decision that the condition of the field of play or its surrounds or that the weather conditions are such as to allow or not to allow a match to take place,
- a decision to abandon a match for whatever reason,
- a decision as to the condition of the fixtures or equipment used during a match including the goalposts, crossbar, flag posts and the ball,
- a decision to stop or not to stop a match due to spectator interference or any problem in the spectator area,
- a decision to stop or not to stop play to allow an injured player to be removed from the field of play for treatment,
- a decision to request or insist that an injured player be removed from the field of play for treatment,
- a decision to allow or not to allow a player to wear certain apparel or equipment,
- a decision (in so far as this may be his responsibility) to allow or not to allow any persons (including team or stadium officials, security officers, photographers or other media representatives) to be present in the vicinity of the field of play,

- any other decision which he may take in accordance with the Laws of the Game or in conformity with his duties under the terms of FIFA, confederation, national association or league rules or regulations under which the match is played.

Decision 2: In tournaments or competitions where a fourth official is appointed, his role and duties must be in accordance with the guidelines approved by the International F.A. Board.

Decision 3: Facts connected with play shall include whether a goal is scored or not and the result of the match.

FIFA LAW 6 – The Assistant Referees

FL 6.1 Duties

Two assistant referees are appointed whose duties, subject to the decision of the referee, are to indicate

- when the whole of the ball has passed out of the field of play,
- which side is entitled to a corner kick, goal kick or throw-in,
- when a player may be penalized for being in an offside position,
- when a substitution is requested,
- when misconduct or any other incident has occurred out of the view of the referee.

	**RoboCup Changes and Comments**
RC-6.1: Duties	In RoboCup, one or more assistants may be appointed for a match. The recommendation is to have three assistant referees. One of the assistant referees should be responsible for time keeping and keeping a game record. The referee may assign assistant referees additional duties aside of those specified in the FIFA Law.

FL 6.2 Assistance

The assistant referees also assist the referee to control the match in accordance with the Laws of the Game.
In the event of undue interference or improper conduct, the referee will relieve an assistant referee of his duties and make a report to the appropriate authorities.

FIFA LAW 7 – The Duration of the Match

FL 7.1 Periods of Play

The match lasts two equal periods of 45 minutes, unless otherwise mutually agreed between the referee and the two participating teams.
Any agreement to alter the periods of play (for example to reduce each half to 40 minutes because of insufficient light) must be made before the start of play and must comply with competition rules.

	**RoboCup Changes and Comments**
RC-7.1: Periods of Play	In RoboCup, a match lasts two equal periods of 15 minutes (clock-time). For friendly games, referee and both teams may decide on different periods of play. In official tournaments, modifications of periods of play may be specified by the organizing committee.

FL 7.2 Half-Time Interval

Players are entitled to an interval at half-time. The half-time interval must not exceed 15 minutes. Competition rules must state the duration of the half-time interval. The duration of the half-time interval may be altered only with the consent of the referee.

	**RoboCup Changes and Comments**
RC-7.2: Half-Time Interval	In RoboCup, the half-time interval must not exceed 10 minutes. The referee may limit the game to the first half if this time is exceeded by clear responsibility of one of the teams. In this case competition rule 3.7 will apply. Upon agreement with both team leaders, the referee may alternatively reduce the second half overall time.

FL 7.3 Allowance for Time Lost

Allowance is made in either period for all time lost through

- substitution(s),
- assessment of injury to players,
- removal of injured players from the field of play for treatment,
- wasting time,
- any other cause.

The allowance for time lost is at the discretion of the referee. The fourth official indicates the minimum additional time decided by the referee at the end of the final minute of each half. The additional time may be increased by the referee but not reduced. The referee must not compensate for a timekeeping error during the first half by changing the length of the second half.

	**RoboCup Changes and Comments**
RC-7.3: Time lost	In RoboCup MSL, the RefBox application shows the actual 'clean' playing time. The OC, taking the tournament schedule into account, can indicate to referees before the match when and how much compensation is possible. When approved by the OC, the referee can compensate for time lost at the end of each half and at the end of each overtime half. The referee indicates the minimum additional time orally.

FL 7.4 Penalty Kick

If a penalty kick has to be taken or retaken, the duration of either half is extended until the penalty kick is completed.

FL 7.5 Extra Time

Competition rules may provide for two further equal periods to be played. The conditions of FIFA LAW 8 will apply.

FL 7.6 Abandoned Match

An abandoned match is replayed unless the competition rules provide otherwise.

FIFA LAW 8 – The Start and Restart of Play

FL 8.1 Preliminaries

A kick-off starts both halves of a match, both halves of extra time and restarts play after a goal has been scored. Free kicks (direct or indirect), penalty kicks, throw-ins, goal kicks and corner kicks are other restarts (see Laws 13–17).
A dropped ball is the restart when the referee stops play and the Law does not require one of the above restarts.
If an offence occurs when the ball is not in play, this does not change how play is restarted.

The referee tosses a coin and the team that wins the toss decides which goal to attack in the first half or to take the kick-off.
Depending on the above, their opponents take the kick-off or decide which goal to attack in the first half.
The team that decided which goal to attack in the first half takes the kick-off to start the second half.
For the second half, the teams change ends and attack the opposite goals.
After a team scores a goal, the kick-off is taken by their opponents.

	**RoboCup Changes and Comments**
RC-8.1.1: Start Delay	For RoboCup, a match must start at the scheduled time. In exceptional situations only, the referee may re-adjust the time for starting the game in accordance with both team leaders. If, in the opinion of the referee, a team causes a delay of more than 3 minutes, and has had access to the field and their team technical area for at least 5 minutes, a warning is given to the team. This warning will be registered on the match form. 3 warnings throughout the tournament (systematic delays) will be penalized with 1 point during round robins or 1 goal for the opponent during the knock-out-phase. For each consecutive warning the same penalty is applied immediately, i.e. a 4^{th} warning leads to a point reduction or a goal for the opponent again.
RC-8.1.2: Remote Start	All robots of a team are started (and stopped) by receiving a signal through wireless communication from outside the field.

FL 8.2 Procedure (for kick-off)

- All players, except the player taking the kick-off, must be in their own half of the field of play.
- The opponents of the team taking the kick-off must be at least 9.15 m (10 yds) from the ball until it is in play.
- The ball must be stationary on the center mark.
- The referee gives a signal.
- The ball is in play when it is kicked and clearly moves.
- A goal may be scored directly against the opponents from the kick-off; if the ball directly enters the kicker's goal, a corner kick is awarded to the opponents.

	**RoboCup Changes and Comments**
RC-8.2: Procedure (for Kick-Off)	For RoboCup, the following procedure is followed for kick-off: • All players are in their own half of the field, with the exception of the robot taking the kick, which is positioned at the ball and may be partially inside the opponent half of the field. • The opponents of the team taking the kick-off must remain at least 3m away from the ball until the ball is in play. • The players of the team taking the kick-off other than the kicking robot must remain at least 2m from the ball until the ball is in play. • No robot, except the kicking robot, is allowed to touch the ball until the ball is in play. • The ball must be stationary on the center mark. • The referee gives a signal. • The robot taking the kick should either use its kicker or one of its sides to instantaneously kick (i.e., without dribbling or dragging) the ball such that it travels freely over a distance of at least 0.5m. • The ball is in play immediately after being kicked. • After the kick, the attacking team is only allowed to touch the ball a second time after it moved over a distance of at least 0.5m. • A goal may be scored only when the ball was touched by another player of the same team. • When 7 seconds have passed and the ball wasn't kicked by the attacking team, the defending team can intercept the ball and start normal play. • If a robot of the attacking team except the kicking robot approaches the ball before the ball is in play, the kick-off will be awarded to the other team. The above mentioned 2m and 3m refers to the radius of a circle centered on the ball. The robots must be completely out of each circle respectively, depending on its status (attacking or defending). Note that when the kick-off is taken backwards, the team may not immediately lob the ball forwards. See RC-10.1.2. The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.
RC-8.2.1: Positioning of Robots	During kick off, robots must autonomously reposition themselves in any position on the field that is consistent with RC-8.2. NOTE: In national or regional competitions only, the local organizing committee may decide if, during kick-off, teams are allowed to manually re-position the robots at the game restart points.

FL 8.3 Infringements/Sanctions (for kick-off)

If the player taking the kick-off touches the ball again before it has touched another player, an indirect free kick, or for a handball offence, a direct free kick, is awarded.
In the event of any other kick-off procedure offence, the kick-off is retaken.

	**RoboCup Changes and Comments**
RC-8.3.1: Kicking Directly to the goal	In RoboCup, if the ball is kicked by the team that has kick-off and enters the goal without being touched by a second player of the same team before crossing the goal line, the goal is not scored: • If the kick-off is kicked directly into the opponents' goal, a goal kick is awarded to the opposing team. • If the kick-off is kicked directly into the team's own goal, a corner kick is awarded to the opposing team. When 7 seconds have passed since the signal and the attacking team did not touch the ball, the defending team can intercept the ball and start normal play. **NOTE:** Rules regarding the validation of scored goals, namely those established in RC-10 and RC-12, overrules or complements all others, including the above one and those defined for every other game restart situations.

FL 8.4 Dropped Ball

A dropped ball is a way of restarting the match after a temporary stoppage which becomes necessary, while the ball is in play, for any reason not mentioned elsewhere in the Laws of the Game.

	**RoboCup Changes and Comments**
RC-8.4.1: Game Stuck	In RoboCup, the referee may call a game stuck situation if there is no progress of the game. The game is continued using the dropped ball procedure. The ball is placed at the point it was when the dropped ball was called.

FL 8.5 Procedure (for dropped ball)

The referee drops the ball at the place where it was located when play was stopped. Play restarts when the ball touches the ground.

	**RoboCup Changes and Comments**
RC-8.5: Procedure (for Dropped Ball)	In RoboCup, the following procedure is followed for dropped ball: • The referee gives a "stop" signal. • All players have to stop their movement. • The ball is stationary positioned in the place where it was located when the game was stopped. • The referee gives a "dropped ball" signal. • All players remain 1m away from the ball. One robot may stay anywhere inside the penalty area (except goal area) of its own team, even if the distance to the ball is shorter than 1m. • The referee gives a "start" signal. • The ball is in play immediately after the referee gives the signal. • In RoboCup a goal may not be scored directly from a dropped ball. • See also "RC-12.3.8 - Delay of game". It is forbidden to reposition robots by hand or by any other means with the only exception of the use of high level coaching of the robots (see FL 3.10, RC-Decision 2.1). The referee may show a yellow card to the robot that doesn't stay at least 1m from the ball, following the referee's instructions more than twice consecutively. After that, if the robot doesn't follow the position restrictions of the procedure, the referee may instruct the team to remove the robot from the field. The above mentioned 1m refers to the radius of a circle centered on the ball. The robots must be completely out of that circle. The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.

FL 8.6 Infringements/Sanctions (for dropped ball)

The ball is dropped again:

- If it is touched by a player before it makes contact with the ground.
- If the ball leaves the field of play after it makes contact with the ground, without a player touching it.

	**RoboCup Changes and Comments**
RC-8.6: Infringements/ Sanctions	If a player moves within 1m from the ball before the referee gives the signal, an indirect free kick is awarded to the opponent.

FL 8.7 Special Circumstances

A free kick awarded to the defending team inside its own goal area is taken from any point within the goal area.
An indirect free kick awarded to the attacking team in its opponents' goal area is taken from the goal area line parallel to the goal line at the point nearest to where the infringement occurred.
A dropped ball to restart the match after play has been temporarily stopped inside the goal area takes place on the goal area line parallel to the goal line at the point nearest to where the ball was located when play was stopped.

FIFA LAW 9 – The Ball In and Out of Play

FL 9.1 Ball Out of Play

The ball is out of play when:

- It has wholly crossed the goal line or touch line whether on the ground or in the air.
- Play has been stopped by the referee.

	**RoboCup Changes and Comments**
RC-9.1.1: Dead Call	In RoboCup, a special "*dead call*" signal may be given by the referee, upon which all robots immediately have to cease operating any kind of actuator. The referee may signal a dead call at any time upon his discretion. In particular, the referee may signal a dead call whenever he considers it necessary to maintain and ensure safety and security of players, team members, referees, and spectators.
RC-9.1.2: Continuation after Dead Call	After a dead call, the game continues with a dropped ball at the position nearest to the ball location when the game was interrupted, except when the referee issued a different call prior to the dead call.

FL 9.2 Ball In Play

The ball is in play at all other times, including when:

- It rebounds from a goalpost, crossbar or corner flag-post and remains in the field of play.
- It rebounds from either the referee or an assistant referee when they are on the field of play.

FIFA LAW 10 – The Method of Scoring

FL 10.1 Goal Scored

A goal is scored when the whole of the ball passes over the goal line, between the goalposts and under the crossbar, provided that no infringement of the Laws of the Game has been committed previously by the team scoring the goal.

	**RoboCup Changes and Comments**
RC-10.1.1: Valid methods of scoring	Any goal scored by a robot in the opponent goal will be only valid if the robot taking the kick is inside the opponent side of the field. This does not apply if the attacking robot kicks into the goal of its own team. Regardless of this rule, all other rules related to indirect fouls procedures still apply. Furthermore, whenever the ball possession is regained by one of the teams, a valid goal can only be scored after the ball has been played by, at least, two robots of the same team. Each time the opponent gains exclusive possession of the ball, the team must perform a pass in order to score a valid goal. A pass on a set-piece situation (free-kick, kick-off, throw in, etc.) counts as a play between two robots, therefore the receiver robot is allowed to score a valid goal if the opponent did not gain exclusive possession of the ball. It is not required that the ball is received on the opponent side of the field. For example, a pass can be made on the own side of the field, the ball can be dribbled to the opponent side (as long as it complies with rule RC-12.0.1) and a goal can be scored. A penalty kick is an exception of this rule, in which no pass is required to score a valid goal. For corner-kicks, free-kicks and throw-ins taken on the opponent side of the field, a touch of a second robot from the same team counts as a "ball received and kicked" for scoring purposes - i.e. the second robot does not need to gain complete control of the ball to score a valid goal. In the aforementioned situations, a touch on the ball towards the opponent goal is enough to score a valid goal (in case the ball enters the goal).

	**RoboCup Changes and Comments**
RC-10.1.2: Lobbing from own half	If a robot makes a lob shot from its own half towards the opponent side of the field without the intention to make a pass and the ball leaves the field, the restart situation is awarded to the opponent team. This rule only applies under the following joint conditions: • The team has three or more robots on the field; • No team mate is within a radius of 2 meters measured from the point where the ball hits the ground; • The ball reaches its highest point in the lob above a height of 60cm. • The ball leaves the field on the opponent side Even if the ball touches and opponent and leaves the field on the opponent side, the next set-play situation would still be awarded to the defending team. If the ball crosses the goal line, a goal-kick is awarded for the defending team; if it crosses the side line on the defending team side, a throw-in is awarded for that team. This is only valid until one of the teams gets control of the ball again.

FL 10.2 Winning Team

The team scoring the greater number of goals during a match is the winner. If both teams score an equal number of goals, or if no goals are scored, the match is drawn.

FL 10.3 Competition Rules

For matches ending in a draw, Competition Rules may state provisions involving extra time, or other procedures approved by the International F.A. Board to determine the winner of a match.

FIFA LAW 11 – Offside

	**RoboCup Changes and Comments**
RC-11: Offside	This law does currently not apply in RoboCup matches.

FL 11.1 Offside Position

It is not an offence in itself to be in an offside position.
A player is in an offside position if:

- He is nearer to his opponents' goal line than both the ball and the second last opponent.

A player is not in an offside position if:

- he is in his own half of the field of play,
- or he is level with the second last opponent,
- or he is level with the last two opponents.

FL 11.2 Offence

A player in an offside position is only penalized if, at the moment the ball touches or is played by one of his team, he is, in the opinion of the referee, involved in active play by:

- interfering with play,
- or interfering with an opponent,
- or gaining an advantage by being in that position.

FL 11.3 No Offence

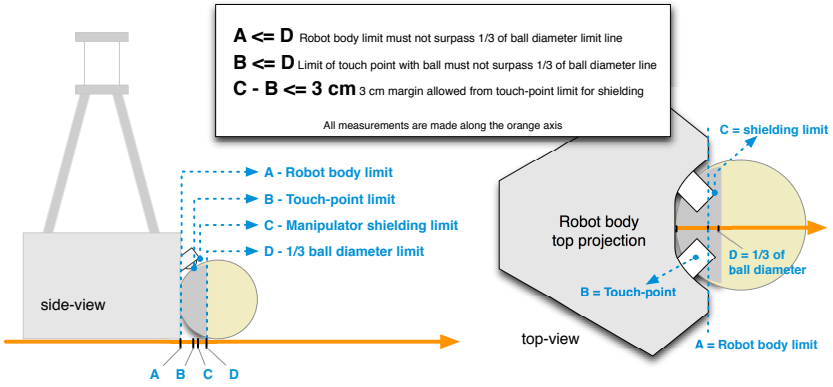
There is no offside offence if a player receives the ball directly from:

- a goal kick,
- or a throw-in,
- or a corner kick.

FL 11.4 Infringements/Sanctions

For any offside offence, the referee awards an indirect free kick to the opposing team to be taken from the place where the infringement occurred.

FIFA LAW 12 – Fouls and Misconduct

RoboCup	RoboCup Changes and Comments
Definition of Permissible Actions for Robot Soccer Players	
RC-12.0.1: Ball Manipulation	• In any case, it must be possible for another robot to take possession of the ball. • The robots must comply with the following limits (measured along the orange axis in the figure): – The ball must not enter the robot body (any part of the robot, excluding the ball manipulators, and respective shielding) top projection convex hull by more than a third of its diameter. This limit becomes half of the ball diameter when the robot is stopping the ball - this case only applies to instantaneous contact between robot and ball lasting no longer than one second. – Any contact point with the ball must not exceed a third of the ball diameter. – An additional margin of 3cm (measured from the contact point limit) is allowed for ball manipulator mechanical shielding/protection, as long as this protection does not touch the ball.  • The robot may exert a force onto the ball only by direct physical contact between robot and ball. Forces exerted onto the ball that hinder the ball from rotating in its natural direction of rotation are allowed for no more than one second and a maximum distance of movement of thirty centimetres. Exerting this kind of forces repeatedly is allowed only either after a waiting time of at least four seconds or if the robot has previously completely released the ball. Natural direction of rotation means that the ball is rotating in the direction of its movement. Forces exerted by the robot onto the ball in order to handle it, may not lift the ball out of the ground. If such situation occurs, a free kick is awarded to the opponent team.

	**RoboCup Changes and Comments**
RC-12.0.1: Ball Manipulation	• Ball rotation also implies that the ball is rotating continuously, even if slightly slower than its natural rotation speed. Movements of the ball such as "roll-stop-roll-stop" are not considered a valid ball rotation and will be considered ball holding. • For any kind of ball dribbling, direct contact between the robot and the ball can only be maintained within a circle with a radius of three meters, centered on the point where the robot last caught the ball. To move past that circle, the robot has to completely release the ball so that this ball release can be directly observable by any of the referees. After that, the robot can capture the ball again and the center of the circle moves to the new catch position. It is up to the referees to determine if the ball has actually been completely released from the robot. Dribbling with direct contact between the robot and the ball outside this circle will be considered ball holding. It is up to the referee to decide if the robot dribbling the ball has complied with the above rule, namely in what concerns the three meters radius. The referee decision on this is final and non disputable. • Dribbling the ball backwards, that is, dribbling while the robot is moving towards the opposite direction of its relative position to the ball is allowed for a maximum distance of 2 meters. During the backward dribble the ball must also be rolling in its natural direction. Once any particular robot has dribbled the ball backwards for more than 1 meter, it can not repeat the same backward dribbling again before the ball has been completely released by that robot or until the robot has engaged a new ball struggle against an opponent robot (i.e. the ball is actively disputed between the two opponent robots for more than 2 seconds). • Violating any of the above rules is considered ball holding.

	**RoboCup Changes and Comments**
RC-12.0.2: Goalkeeper Ball Manipulation	• Goalkeepers are allowed to have an extra ball catch hardware system. Such system must be designed to be able to grab the ball, hold it for a short period of time and put it back in play (by releasing it from this system) - all within 6 seconds. • This system can only be used inside the penalty area, after an opponent kick and cannot be used to intentionally hide the ball from the opponent. • This system may enclose the ball more than 1 third of its diameter, as long as the ball stays visible to the opponent. • In cases where this ball catch hardware is an active system, it can make use of the extended robot size, but cannot be used at the same time as other "extending arms" (See RC-4.2.0). If it is a passive system, it can be used along with any "extending arms", as there might be no way to turn this system off. • Violating the 6 seconds rule is considered ball holding. • When with the ball possession, the goalkeeper should not be prevented from releasing the ball (if the keeper is blocked from releasing the ball, the 6 seconds limit does not apply). Opponent players should show effort in driving away from the keeper. • In cases where the keeper is prevented from releasing the ball, if the opponent does not make an effort to move away from the keeper, a goal-kick may be awarded to the team in possession of the ball if the game becomes stuck.

Fouls and misconduct are penalized as follows:

FL 12.1 Direct Free Kick

A direct free kick is awarded to the opposing team if a player commits any of the following six offences in a manner considered by the referee to be careless, reckless or using excessive force:

- kicks or attempts to kick an opponent
- trips or attempts to trip an opponent
- jumps at an opponent
- charges an opponent
- strikes or attempts to strike an opponent
- pushes an opponent

A direct free kick is also awarded to the opposing team if a player commits any of the following four offences:

- tackles an opponent to gain possession of the ball, making contact with the opponent before touching the ball
- holds an opponent
- spits at an opponent
- handles the ball deliberately (except for the goalkeeper within his own penalty area)

A direct free kick is taken from where the offence occurred.

	**RoboCup Changes and Comments**
RC-12.1: Direct Free Kick	Direct free kicks are currently awarded as indirect free kicks.

FL 12.2 Penalty Kick

A penalty kick is awarded if any of the above ten offences is committed by a player inside his own penalty area, irrespective of the position of the ball, provided it is in play.

	**RoboCup Changes and Comments**
RC-12.2: Penalty Kick	In RoboCup, a penalty kick is awarded whenever a pushing offense (defined in RC-12.3.2) is committed inside the penalty area. The competition rules may specify the execution of penalty kicks to decide the winner of a game which ends in a draw.

FL 12.3 Indirect Free Kick

An indirect free kick is awarded to the opposing team if a goalkeeper, inside his own penalty area, commits any of the following five offences:

- takes more than four steps while controlling the ball with his hands, before releasing it from his possession

- touches the ball again with his hands after it has been released from his possession and has not touched any other player
- touches the ball with his hands after it has been deliberately kicked to him by a team-mate
- touches the ball with his hands after he has received it directly from a throw-in taken by a team-mate
- wastes time

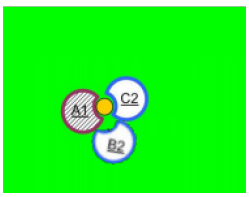
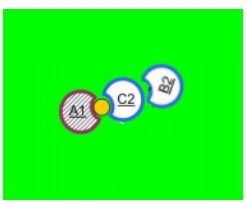
An indirect free kick is also awarded to the opposing team if a player, in the opinion of the referee:

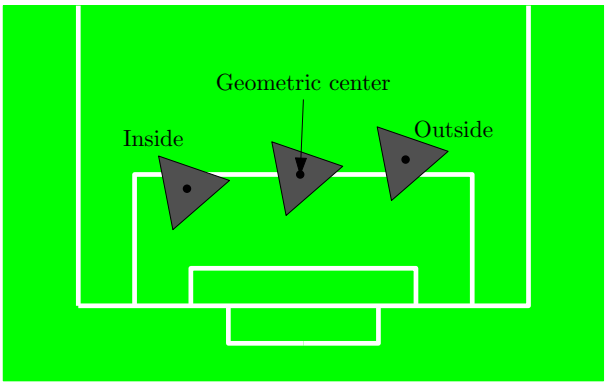
- plays in a dangerous manner
- impedes the progress of an opponent
- prevents the goalkeeper from releasing the ball from his hands
- commits any other offence, not previously mentioned in Law 12, for which play is stopped to caution or dismiss a player

The indirect free kick is taken from where the offence occurred.

	**RoboCup Changes and Comments**
RC-12.3: Indirect Free Kick	An indirect free kick is awarded to the opposing team, if a player, in the opinion of the referee, commits any of the following offences: • holding the ball • pushing an opponent • manual interference (see below) • kicking an opponent • performing illegal defense • performing illegal attack • delay of game **Manual interference:** An indirect free kick is awarded to the opposing team, if a human member of a team, in the opinion of the referee, commits any of the following offences: • entering the field during the game without permission of the referee • touching the robot during the game without permission of the referee • interfering with the game on the field, e.g. through touching the ball while removing a robot • deliberately delay the removal of a robot from the field during a game stoppage. It is up to the referee decision to evaluate those situations • behaving otherwise in an unsportsmanlike manner The referee may stop the game and give a yellow card to the player or the human member of the team that has committed one of those offences. The indirect free kick will be started from where the ball was when the offences occurred if the ball was not inside a penalty area, and from the closest restart point if the ball was inside of a penalty area. The offences are described and clarified subsequently.

	**RoboCup Changes and Comments**
RC-12.3.1: Ball Holding	If a player commits any violation of the clauses on stopping, dribbling, or kicking the ball, a **ball holding foul** will be called. Ball holding or hindering the ball from rolling in its natural direction is only allowed for at most one second and at most 30cm of movement. This kind of action can only be repeated after a waiting time of, at least, four seconds.

	RoboCup Changes and Comments
RC-12.3.2: Pushing	• Robots must play such that they try to avoid physical contact. However, physical contact *per se* does not represent an offence. • All robots must be equipped to detect situations of physical contact with other robots (direct pushing situations). The obligation to detect pushing situations includes also indirect contact with another robot through the ball (i.e. the ball is between the player and an opponent). • If physical contact with other robots cannot be avoided, it must be **soft**, i.e. at slow speed and with as small physical impact as possible, in order to avoid damage to itself and other robots. Robots moving at high speed must significantly decelerate before a collision with another robot. • Whenever a robot produces direct or indirect physical contact with another robot while moving, it must stop movement immediately in that direction and choose a new direction for movement. If pushing occurs between a moving and a standing robot, the moving robot causes the pushing situation and is responsible for resolving it. • If pushing occurs between two moving robots, both robots are responsible for resolving the pushing situation. If one robot continues pushing by moving in its initial direction, while the other robot is recognizably reacting and trying to take another direction, the foul will be called on the pushing robot. • If an indirect pushing situation occurs between two robots, and neither of the robots can come out of it or shows significant attempts to get out of it within 10 seconds, a dropped ball will be called. • While two robots from opponent teams are actively disputing the ball, if the robot from one of the teams keep pushing the opponent by continuously exerting a force over the ball forcing the opponent to move back, a pushing foul will be called. • If two robots encounter physical contact and cannot resolve the situation because they get entangled, the referee may issue a Dead Call (see RC-9.1.1) and order, afterwards, robot attendants to enter the field and slightly separate the entangled robots. • While two robots from opponent teams are actively disputing the ball (example below), no other robot from either team can produce a direct contact with the ball or the opponent team's robot. If more than one robot is actively trying to intercept an opponent robot which is currently dribbling the ball then, as soon as one robot from the team that is trying to intercept is able to touch the ball, the other should move away, and can no longer be in contact with either the ball or the opponent team's robot. Violation of this rule will result in a pushing foul awarded to the offended team." **It is up to the referee to evaluate the number and level of seriousness of pushing fouls. The referee can and should, at is own discretion, show the offending robot either a yellow or a red card whenever a serious pushing foul occurs.** Offense: Allowed:  

	RoboCup Changes and Comments
RC-12.3.3: Kicking	The pushing clauses above apply in a similar manner to kicking motions: • Robots must avoid kicking each other. However, physical contact through an actuated kicking device does not *per se* represent an offence. • All robots must be equipped to decide whether they can execute a kick without threatening or damaging other robots. • If physical contact with other robots cannot be avoided, it must be **soft**, i.e. with small force. The stronger a kicking device is designed, the more fine-grained control of its activation is required. • If, in the opinion of the referee, physical contact through a kicking device is not soft, a **kicking foul** will be called.
RC-12.3.4: Illegal Defense	• Only the goal keeper may stay permanently in the own penalty area of a team. • A time limit of 10 seconds is allowed for a defending robot to leave its own penalty area. The referee may extend the time limit at his own discretion if the robot is actively making progress to leave the penalty area, or if it is prevented from leaving the penalty area by other robots. • If, in the opinion of the referee, a defending robot is not taking appropriate action to leave its own penalty area, an **illegal defense foul** will be called. • If a second defending robot is in the own penalty area, an **illegal defense foul** will be called. • This rule overrides all other rules. • A robot is considered to be inside the penalty area if the projection of the robot's geometric center on the field overlaps or goes beyond the penalty area line. • The line of the penalty area is a part of the penalty area itself. 

	**RoboCup Changes and Comments**
RC-12.3.5: Illegal Attack	• A time limit of 10 seconds is allowed for an attacking robot to (possibly execute a kick motion and) leave the opponent's penalty area. The referee may extend the time limit at his own discretion, if the robot is actively making progress to leave the opponent's penalty area, or if it is prevented from leaving the penalty area by other robots. • If, in the opinion of the referee, the attacking robot is not taking appropriate action to leave the opponent's penalty area an **illegal attack foul** will be called. • If a second attacking robot is in the opponent's penalty area, an **illegal attack foul** will be called. • This rule overrides all other rules. • The line of the penalty area is a part of the penalty area itself. • Touching the goalie in his goal area is an illegal attack foul; independently of the question whether the goalie moved to the attacker or vice versa. The goalie is considered to be inside the goal area as long as the projection of its geometric center on the field is inside or over the goal area limit.
RC-12.3.6: Manual Interference	• Robot attendants must, at all times, avoid any interference with the game process. • If, in the opinion of the referee, a human team member is interfering with the game process on the field, a **manual interference foul** will be called (e.g. touching the robots during the game without the intention to take them out for repair). • A team member asking the spectators to move or hide because they wear clothes with colors used in RoboCup, interferes also with the game process. A referee can treat this also as a **manual interference foul**.
RC-12.3.7: Remote Interference	• No remote human interference of any kind with the game process is allowed. • In particular, the laptops used for coaching the robots (base station) must remain closed for the full duration of the game. • If, in the opinion of the referee, a human team member is remotely interfering with the game through wireless communication (e.g. by remotely joysticking a robot, or sending commands to robots from any machine/computer outside of the field of play in order to convey information about the position of objects on the field or activate particular patterns of actions on the robots), the team is disqualified for that particular match, and the final result will be obtained according to the rules of (CR 3.7 Withdrawal from game). • The only exception to the above rules is high level coaching of the robots (see FL 3.10, RC-Decision 2.1).

	**RoboCup Changes and Comments**
RC-12.3.8: Delay Of Game	The following situations specify (non exclusively) when a **delay of game foul** can be called. • If a player removes (for the second time) the ball from its position during a game-stoppage. • Wasting time during repair or substitution (a time limit for the latter is specified in RC-3.5.) • Repeatedly shooting the ball out of the field. • Holding the ball without moving, when other actions are possible. **Note:** Defending (shielding the ball from an opponent who is within 1 meter) **is not** delay of the game.
RC-12.3.9: Unsportsmanlike Behaviour	• Human team members must at all times during the match behave in an appropriate manner. • At least the following behaviours are considered unsportsmanlike: – not following instructions of the referee and the assistant referees – yelling at or insulting the referees, or the opponent, or the audience – deliberately delay the removal of a robot from the field during a game stoppage. • If, in the opinion of the referee, a human team member is behaving in an inappropriate manner, an **unsportsmanlike behaviour foul** will be called.
RC-12.3.10: Goalie Protection	• Only the goalie is allowed to be in the goal area. • If an attacking robot enters the defender's goal area (i.e. when the projection of the robot's geometric center on the field overlaps or goes beyond the goal area line), then it will cause a foul. • If a defending robot other than the goalie enters the defender's goal area (i.e. when the projection of the robot's geometric center on the field overlaps or goes beyond the goal area line), then it will cause a foul. • The line of the goal area is a part of the goal area itself.
RC-12.3.11: Manual Positioning	• It is not allowed to re-position robots manually during a game-stoppage. If a robot needs to be re-positioned, it has to be taken out for repair. See also NOTE from RC-8.2.1.

FL 12.4 Disciplinary Sanctions

Only a player or substitute or substituted player may be shown the red or yellow card.

FL 12.5 Cautionable Offences

A player is cautioned and shown the yellow card if he commits any of the following seven offences:

- is guilty of unsporting behaviour
- shows dissent by word or action
- persistently infringes the Laws of the Game
- delays the restart of play
- fails to respect the required distance when play is restarted with a corner kick or free kick
- enters or re-enters the field of play without the referee's permission
- deliberately leaves the field of play without the referee's permission

	**RoboCup Changes and Comments**
RC-12.5: Cautionable Offences	In RoboCup, a robot player or human team member is cautioned **and shown the yellow card** if he commits any of the following offences: • is guilty of unsporting behaviour • persistently infringes the Laws of the Game • delays the restart of play • fails to respect the required distance when play is restarted with a corner kick, goal kick, throw in or free kick • enters the field of play without the referee's permission. Exceptions are defined in RC-4.1 and RC-5.3.2 • crash at high speed with the field safety boundary, Goal, or any other robot
RC-12.5.1: Yellow Cards	The assistant referees will maintain a count of yellow cards given to each player (e.g. by the RefBox).

FL 12.6 Sending-Off Offences

A player is sent off and shown the red card if he commits any of the following seven offences:

- is guilty of serious foul play
- is guilty of violent conduct
- spits at an opponent or any other person
- denies the opposing team a goal or an obvious goal-scoring opportunity by deliberately handling the ball (this does not apply to a goalkeeper within his own penalty area)
- denies an obvious goal-scoring opportunity to an opponent moving towards the player's goal by an offence punishable by a free kick or a penalty kick
- uses offensive, insulting or abusive language
- receives a second caution in the same match

	**RoboCup Changes and Comments**
RC-12.6.1: Temporary Sent-Off	A player is temporarily sent off the field after any of its team members or robots receives a second yellow card. If the second yellow card is given to a player, this player must be removed. If the second yellow card is given to a team member, the team may choose which player is to be removed. The player may return to the game on the next game interrupt, but no less than 90 seconds of actual play time (only counts when game is on play-on) after being temporarily sent off. The counting of the yellow cards is reset after a player is given a 90 seconds off penalty.
RC-12.6.2: Sending-Off Offences	A robot player or human team member is shown the red card and sent off for the remainder of the game if it commits any of the following offences: • is guilty of serious foul play, especially when exhibiting behaviour considered to be reckless and rude, or presenting a threat to other robots, human team members, the referees, and the audience • spits at an opponent or any other person • denies the opposing team a goal or an obvious goal-scoring opportunity by deliberately handling the ball (this applies only to human team members) • is guilty of violent conduct • uses offensive, insulting or abusive language • crashes at high speed with the field safety boundary or Goal causing substantial damages on it • crashes at high speed with any other robot causing visible and substantial damage on it • its team is punished with a third ”90 seconds off” penalty

Decisions of the International F.A. Board

Decision 1: A penalty kick is awarded if, while the ball is in play, the goalkeeper, inside his own penalty area, strikes or attempts to strike an opponent by throwing the ball at him.

Decision 2: A player who commits a cautionable or sending-off offence, either on or off the field of play, whether directed towards an opponent, a team-mate, the referee, an assistant referee or any other person, is disciplined according to the nature of the offence committed.

Decision 3: The goalkeeper is considered to be in control of the ball by touching it with any part of his hand or arms. Possession of the ball includes the goalkeeper deliberately parrying the ball, but does not include the circumstances where, in the opinion of the referee, the ball rebounds accidentally from the goalkeeper, for example after he has made a save. The goalkeeper is considered to be guilty of time-wasting if he holds the ball in his hands or arms for more than 5-6 seconds.

Decision 4: Subject to the terms of Law 12, a player may pass the ball to his own goalkeeper using his head or chest or knee, etc. If, however, in the opinion of the referee, a player uses a deliberate trick while the ball is in play in order to circumvent the Law, the player is guilty of unsporting behaviour. He is cautioned, shown the yellow card and an indirect free kick is awarded to the opposing team from the place where the infringement occurred.

A player using a deliberate trick to circumvent the Law while he is taking a free kick, is cautioned for unsporting behaviour and shown the yellow card. The free kick is retaken.

In such circumstances, it is irrelevant whether the goalkeeper subsequently touches the ball with his hands or not. The offence is committed by the player in attempting to circumvent both the

letter and the spirit of Law 12.

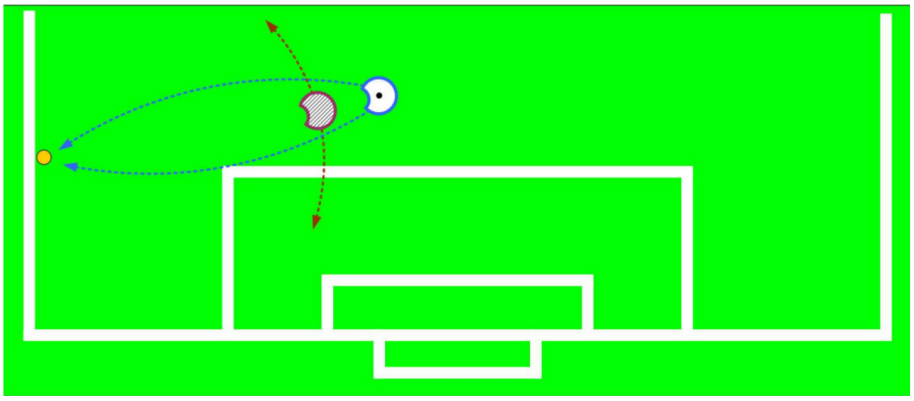
Decision 5: A tackle from behind, which endangers the safety of an opponent, must be sanctioned as serious foul play.

	**RoboCup Changes and Comments**
RC-Decision 1-4:	The Intl. F.A. Board Decisions 1 to 4 do currently not apply to RoboCup.

FIFA LAW 13 – Free Kicks

FL 13.1 Types of Free Kicks

Free kicks are either direct or indirect.
For both direct and indirect free kicks, the ball must be stationary when the kick is taken and the kicker does not touch the ball a second time until it has touched another player.

	**RoboCup Changes and Comments**
RC-13.1.1: Free kicks	In RoboCup, an indirect free kick is awarded in all situations where the Laws of the Game specify a direct free kick.
RC-13.1.2: Touching	In RoboCup, the kicker may touch the ball more than one time as long as the ball has not moved over a distance of more than 20cm after an indirect free kick. After that, the ball must role freely for 0.5m and then must be touched by another player before the kicking robot can touch the ball again. A goal may be scored only after the ball has been touched by another player of the same team.
RC-13.1.3: Obstruction in re-positionings	• During stoppage time and right after the referee indicates the nature of the foul and the restart situation, robots from the defending team are not allowed to deliberately block the movement and/or access of the robots from the opponent team to the ball position; • During this period and until a Start Signal is given, robots from the defending team may not place themselves directly over the virtual line that connects the ball and any of the opponents; • If such situation happens and is judged by the referee as deliberate, a yellow card is shown to the offending robot. 
RC-13.1.4: Moving the ball in re-positionings	• During stoppage time and right after the referee indicates the nature of the foul and the restart situation, the robots are not allowed to deliberately touch the ball before the Start Signal is given • If such situation happens repetitively when the robot had conditions to avoid the ball, a yellow card is shown to the offending robot.

FL 13.2 The Direct Free Kick

- If a direct free kick is kicked directly into the opponents' goal, a goal is awarded.
- If a direct free kick is kicked directly into the team's own goal, a corner kick is awarded to the opposing team.

FL 13.3 The Indirect Free Kick

Signal The referee indicates an indirect free kick by raising his arm above his head. He maintains his arm in that position until the kick has been taken and the ball has touched another player or goes out of play.

Ball Enters the Goal A goal can be scored only if the ball subsequently touches another player before it enters the goal.

- If an indirect free kick is kicked directly into the opponents' goal, a goal kick is awarded.
- If an indirect free kick is kicked directly into the team's own goal, a corner kick is awarded to the opposing team.

FL 13.4 Position of Free Kick

Free Kick Inside the Penalty Area

Direct or indirect free kick to the defending team:

- all opponents are at least 9.15m (10yds) from the ball.
- all opponents remain outside the penalty area until the ball is in play.
- the ball is in play when it is kicked directly beyond the penalty area.
- a free kick awarded in the goal area is taken from any point inside that area.

Indirect free kick to the attacking team:

- All opponents are at least 9.15m (10yds) from the ball until it is in play, unless they are on their own goal line between the goalposts.
- the ball is in play when it is kicked and moves
- an indirect free kick awarded inside the goal area is taken from that part of the goal area line which runs parallel to the goal line, at the point nearest to where the infringement occurred.

Free Kick Outside the Penalty Area

- All opponents are at least 9.15m (10yds) from the ball until it is in play.
- The ball is in play when it is kicked and moves.
- The free kick is taken from the place where the infringement occurred.

	**RoboCup Changes and Comments**
RC-13.4: Position of the Free Kick	For RoboCup, replace "*9.15m*" with "**3m or anywhere (except goal area) within their own penalty area**". This means that one robot may be placed anywhere inside the own penalty area (except goal area), even if the distance to the ball is shorter than 3m.

	**RoboCup Changes and Comments**
RC-13.4.1: Procedure	In RoboCup, the following procedure is used for free-kick: • The referee gives a "stop" signal. • All players have to stop their movement. • The indirect free kick will be started from where the ball was when the offences occurred, if the ball was not inside a penalty area and from the closest restart point if the ball was inside of a penalty area. • The referee gives a "free-kick" signal. • The robot of the attacking team that is taking the kick is positioned at the ball. • All other players of the free-kick awarded team can stay anywhere on the field except in a circle with a radius of 2m around the ball until the ball is in play. • All players of the defending team can stay anywhere on the field except in a circle with a radius of 3m around the ball until the ball is in play. One robot may stay anywhere inside the penalty area (except goal area) of its own team, even if the distance to the ball is shorter than 3m. • The referee gives a "start" signal. • A player of the team who was awarded the free-kick kicks the ball. • The robot taking the kick should either use its kicker or one of its sides to instantaneously kick (i.e., without dribbling or dragging) the ball such that it travels freely over a distance of at least 0.5m. • The ball is in play immediately after being kicked. • After the kick, the attacking team is only allowed to touch the ball a second time after it moved over a distance of at least 0.5m. • A goal may be scored only when the ball was touched by another player of the same team. • When 7 seconds have passed after the signal and the ball was not kicked by the attacking team, the defending can intercept the ball and start normal play. • If a robot of the attacking team except the kicking robot approaches the ball before the ball is in play, the free-kick will be awarded to the other team. It is forbidden to re-position robots by hand or by any other means with the only exception of the use of high level coaching of the robots (see FL 3.10, RC-Decision 2.1). The referee may show a yellow card to the robot that doesn't stay at least 2m (for the attacking team) or 3m (for the defending team) from the ball, following the referee's instructions. After that, if the robot doesn't follow the position restrictions of the procedure, the referee will show a second yellow card and the robot that received this card must be removed from the field for 90 seconds. The above mentioned 2m and 3m refers to the radius of a circle centered on the ball. The robots must be completely out of each circle respectively, depending on its status (attacking or defending). The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.

FL 13.5 Infringements/Sanctions

If, when a free kick is taken, an opponent is closer to the ball than the required distance:

- the kick is retaken.

If, when a free kick is taken by the defending team from inside its own penalty area, the ball is not kicked directly into play:

- the kick is retaken.

Free kick taken by a player other than the goalkeeper

If, after the ball is in play, the kicker touches the ball a second time (except with his hands) before it has touched another player:

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred .

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player:

- a direct free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.
- a penalty kick is awarded if the infringement occurred inside the kicker's penalty area.

Free kick taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball a second time (except with his hands), before it has touched another player:

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- a direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.
- an indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.

	**RoboCup Changes and Comments**
RC-13.5: Infringements/ Sanctions	In RoboCup, all clauses referring to situations, where the player taking the free kick is touching the ball a second time, do currently not apply, except for the limitations defined in RC-13.1.2.

FIFA LAW 14 – The Penalty Kick

A penalty kick is awarded against a team which commits one of the ten offences for which a direct free kick is awarded, inside its own penalty area and while the ball is in play.
A goal may be scored directly from a penalty kick.
Additional time is allowed for a penalty kick to be taken at the end of each half or at the end of periods of extra time.

FL 14.1 Position of the Ball and the Players

The ball:

- is placed on the penalty mark.

The player taking the penalty kick:

- is properly identified.

The defending goalkeeper:

- remains on his goal line, facing the kicker, between the goalposts until the ball has been kicked.

The players other than the kicker are located:

- inside the field of play.
- outside the penalty area.
- behind the penalty mark.
- at least 9.15m (10yds) from the penalty mark.

	**RoboCup Changes and Comments**
RC-14.1: Position of Ball and Players	In RoboCup, the following modification apply: • The defending goal keeper stays within his own goal area until the ball is even slightly moved. • The goalie can move at any time as long as it does not leave its goal area. • In case of an end-of-game penalty sequence, the kicker is located inside the center circle. For an in-game penalty the kicker is located on a line from the penalty spot to the center circle, approximately one meter from the penalty spot. • In case of an end-of-game penalty sequence, the players other than the kicker and goalie are located inside the field of play, outside the center circle, and behind the center line on the opposite side of the defending goal keeper. For an in-game penalty, the players other than the kicker and goalie are located inside the field of play, at least three meters away from the penalty spot and not in the penalty area.

FL 14.2 The Referee

- does not signal for a penalty kick to be taken until the players have taken up position in accordance with the Law.
- decides when a penalty kick has been completed.

	**RoboCup Changes and Comments**
RC-14.2: The Referee	The "Penalty Procedure" (RC 14.3) specifies additional criteria for deciding when a penalty kick has been completed.

FL 14.3 Procedure

- The player taking the penalty kicks the ball forward.
- He does not play the ball a second time until it has touched another player.
- The ball is in play when it is kicked and moves forward.

When a penalty kick is taken during the normal course of play, or time has been extended at half-time or full time to allow a penalty kick to be taken or retaken, a goal is awarded if, before passing between the goalposts and under the crossbar:

- the ball touches either or both of the goalposts and/or the crossbar, and/or the goalkeeper.

	**RoboCup Changes and Comments**
RC-14.3: End-of-game	For end-of-game penalty sequences the following procedure applies: • The penalty starts 5 min. after the end of the game. • Each team is awarded five penalty shots. • All players take their positions. The ball is placed on the penalty mark by the referee or one of the assistant referees. • The assistant referee gives a 'penalty' signal. • The referee gives a 'start' signal. • The field robot that is taking the penalty must stay inside the center circle until the "start" signal is issued. • The ball is in play when it was even slightly moved by the field robot. • After the field robot catches the ball, the ball may only move, at most 20cm, and always in the direction towards the goal. • The robot must kick the ball before the ball moves more than the above defined 20cm, otherwise no goal is awarded. • The goalie is allowed to move at any time within the goal area only. • A goal is awarded if the ball passes the goal line between the goal posts and under the crossbar within 30 seconds after the "start" signal of the referee. • No field player can touch the ball again and exert force on it after it has been touched by the goal keeper. • If the goalie leaves the goal area this shot will be repeated. If the same happens again the goal will be awarded. • It is only allowed to kick the ball once. • All 5 penalties of one team are taken sequentially, in cycling order by the field-players which were on the field of play at the end of the match, followed directly by the 5 penalties of the other team. • If after the series, there is a tie, the penalty shoot-out will be repeated. If after 5 more penalties of each team there is still no winner, the game will be decided according to competition rule 3.5.

	**RoboCup Changes and Comments**
RC-14.4: In-game penalties	For in-game penalties the following procedure applies: • The penalty starts within 30 seconds after it was awarded by the referee. • The assistant referee gives a 'penalty' signal. • All players take their positions. The ball is placed on the penalty mark by the referee or one of the assistant referees. • The assistant referee gives a 'start' signal. • Only the defending goalkeeper and the robot taking the penalty may leave their position. • The ball is in play when it was even slightly moved by the field robot taking the penalty. Other robots may leave their penalty position from this point on. • In case the robot taking the penalty fails to get to the ball within 10 seconds, the penalty sequence ends and normal game play continues. • After the field robot catches the ball, the ball may only move, at most 20cm, and always in the direction towards the goal. • The robot must kick the ball before the ball moves more than the above defined 20cm, otherwise no goal is awarded. • The goalie is allowed to move at any time within the goal area only. • If the goalie leaves the goal area this shot will be repeated. If the same happens again the goal will be awarded.

FL 14.4 Infringements/Sanctions

If the referee gives the signal for a penalty kick to be taken and, before the ball is in play, one of the following situations occurs:

The player taking the penalty kick infringes the Laws of the Game:

- The referee allows the kick to proceed.
- If the ball enters the goal, the kick is retaken.
- If the ball does not enter the goal, the kick is not retaken.

The goalkeeper infringes the Laws of the Game:

- The referee allows the kick to proceed.
- If the ball enters the goal, a goal is awarded.
- If the ball does not enter the goal, the kick is retaken.

A team-mate of the player taking the kick enters the penalty area or moves in front of or within 9.15 m (10 yds) of the penalty mark:

- The referee allows the kick to proceed.
- If the ball enters the goal, the kick is retaken.

- If the ball does not enter the goal, the kick is not retaken.
- If the ball rebounds from the goalkeeper, the crossbar or the goal post and is touched by this player, the referee stops play and restarts the match with an indirect free kick to the defending team.

A team-mate of the goalkeeper enters the penalty area or moves in front of or within 9.15 m (10 yds) of the penalty mark:

- The referee allows the kick to proceed.
- If the ball enters the goal, a goal is awarded.
- If the ball does not enter the goal, the kick is retaken.

A player of both the defending team and the attacking team infringe the Laws of the Game:

- The kick is retaken.

If, after the penalty kick has been taken:

The kicker touches the ball a second time (except with his hands) before it has touched another player:

- An indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

The kicker deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

The ball is touched by an outside agent as it moves forward:

- the kick is retaken.

The ball rebounds into the field of play from the goalkeeper, the crossbar or the goalposts, and is then touched by an outside agent:

- The referee stops play.
- Play is restarted with a dropped ball at the place where it touched the outside agent.

	**RoboCup Changes and Comments**
RC-14.5: Infringements/ Sanctions	For RoboCup, replace "*enters the penalty area or moves in front of or within 9.15m (10yds) of the penalty mark*" with "**enters the side of the field where the penalty kick takes place**" (end-of-game penalty) or "**enters the penalty area or moves within 3 meters from the penalty mark** (in-game penalty).

FIFA LAW 15 – The Throw-In

A throw-in is a method of restarting play.
A goal cannot be scored directly from a throw-in.
A throw-in is awarded

- when the whole of the ball passes over the touch line, either on the ground or in the air,
- from the point where it crossed the touch line,
- to the opponents of the player who last touched the ball.

FL 15.1 Procedure (The Throw-In)

At the moment of delivering the ball, the thrower

- faces the field of play,
- has part of each foot either on the touch line or on the ground outside the touch line,
- uses both hands,
- delivers the ball from behind and over his head.

The thrower may not touch the ball again until it has touched another player.
The ball is in play immediately after it enters the field of play.

	**RoboCup Changes and Comments**
RC-15.1: Procedure	In RoboCup, the following procedure is used for throw-in: • The referee gives a "stop" signal. • All players have to stop their movement. • The ball is placed on the touch line by the referee or one of the assistant referees. • The referee gives a "throw-in" signal. • The robot of the attacking team that is taking the kick is positioned at the ball. • All other players of the throw-in awarded team can stay anywhere on the field except in a circle with a radius of 2m around the ball until the ball is in play. • All players of the defending team can stay anywhere on the field except in a circle with a radius of 3m around the ball until the ball is in play. One robot may stay anywhere inside the penalty area (except goal area) of its own team, even if the distance to the ball is shorter than 3m. • The referee gives a "start" signal. • A player of the team who was awarded the throw-in kicks the ball. • The robot taking the kick should either use its kicker or one of its sides to instantaneously kick (i.e., without dribbling or dragging) the ball such that it travels freely over a distance of at least 0.5m. • The ball is in play immediately after being kicked. • After the kick, the attacking team is only allowed to touch the ball a second time after it moved over a distance of at least 0.5m. • A goal may be scored only when the ball was touched by another player of the same team. • When 7 seconds have passed after the signal and the ball wasn't kicked by the attacking team, the defending team can can intercept the ball and start normal play. • If a robot of the attacking team except the kicking robot approaches the ball before the ball is in play, a free-kick will be awarded to the other team. It is forbidden to re-position robots by hand or by any other means with the only exception of the use of high level coaching of the robots (see FL 3.10, RC-Decision 2.1). The referee may show a yellow card to the robot that doesn't stay at least 2m (for the attacking team) or 3m (for the defending team) from the ball, following the referee's instructions. After that, if the robot doesn't follow the position restrictions of the procedure, the referee will show a second yellow card and the robot that received this card must be removed from the field for 90 seconds.

	**RoboCup Changes and Comments**
RC-15.1: Procedure	The above mentioned 2m and 3m refers to the radius of a circle centered on the ball. The robots must be completely out of each circle respectively, depending on its status (attacking or defending). The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.

FL 15.2 Infringements/Sanctions

Throw-in taken by a player other than the goalkeeper

If, after the ball is in play, the thrower touches the ball a second time (except with his hands) before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the thrower deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.
- A penalty kick is awarded if the infringement occurred inside the thrower's penalty area.

Throw-in taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball a second time (except with his hands), before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.
- An indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.

If an opponent unfairly distracts or impedes the thrower

- he is cautioned for unsporting behaviour and shown the yellow card.

For any other infringement of this Law

- the throw-in is taken by a player of the opposing team.

	**RoboCup Changes and Comments**
RC-15.2: Infringements/ Sanctions	In RoboCup, all clauses referring to situations, where the player taking the throw-in is touching the ball a second time, do currently not apply, except for the limitations defined in RC-13.1.2.

FIFA LAW 16 – The Goal Kick

A goal kick is a method of restarting play.
A goal may be scored directly from a goal kick, but only against the opposing team.
A goal kick is awarded when

- the whole of the ball, having last touched a player of the attacking team, passes over the goal line, either on the ground or in the air, and a goal is not scored in accordance with Law 10

FL 16.1 Procedure (for Goal Kick)

- The ball is kicked from any point within the goal area by a player of the defending team.
- Opponents remain outside the penalty area until the ball is in play.
- The kicker does not play the ball a second time until it has touched another player.
- The ball is in play when it is kicked directly beyond the penalty area.

	**RoboCup Changes and Comments**
RC-16.1: Procedure	In RoboCup, the following procedure is used for a goal kick: • The referee gives a "stop" signal. • All players have to stop their movement. • The ball is placed at the nearest restart marker to the position where the ball passed the goal line by the referee or one of the assistant referees. • The referee gives a "goal kick" signal. • The robot of the attacking team that is taking the kick is positioned at the ball. • All other players of the goal kick awarded team can stay anywhere on the field except in a circle with a radius of 2m around the ball until the ball is in play. • All players of the opponent team can stay anywhere on the field except in a circle with a radius of 3m around the ball until the ball is in play. • The referee gives a "start" signal. • A player of the team who was awarded the goal kick kicks the ball. • The robot taking the kick should either use its kicker or one of its sides to instantaneously kick (i.e., without dribbling or dragging) the ball such that it travels freely over a distance of at least 0.5m. • The ball is in play immediately after being kicked. • After the kick, the attacking team is only allowed to touch the ball a second time after it moved over a distance of at least 0.5m. • A goal may be scored only when the ball was touched by another player of the same team. • When 7 seconds have passed after the signal and the ball wasn't kicked by the attacking team, the defending team can intercept the ball and start normal play. • If a robot of the attacking team except the kicking robot approaches the ball before the ball is in play, a free-kick will be awarded to the other team. It is forbidden to re-position robots by hand or by any other means with the only exception of the use of high level coaching of the robots (see FL 3.10, RC-Decision 2.1). The referee may show a yellow card to the robot that doesn't stay at least 2m (for the attacking team) or 3m (for the defending team) from the ball, following the referee's instructions. After that, if the robot doesn't follow the position restrictions of the procedure, the referee will show a second yellow card and the robot that received this card must be removed from the field for 90 seconds. The above mentioned 2m and 3m refers to the radius of a circle centered on the ball. The robots must be completely out of each circle respectively, depending on its status (attacking or defending). The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.

FL 16.2 Infringements/Sanctions

If the ball is not kicked directly into play beyond the penalty area

- the kick is retaken.

Goal kick taken by a player other than the goalkeeper

If, after the ball is in play, the kicker touches the ball a second time (except with his hands) before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.
- A penalty kick is awarded if the infringement occurred inside the kicker's penalty area

Goal kick taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball a second time (except with his hands) before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.
- An indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.

For any other infringement of this Law:

- The kick is retaken

	**RoboCup Changes and Comments**
RC-16.2: Infringements/ Sanctions	In RoboCup, all clauses referring to situations, where the player taking the goal kick is touching the ball a second time, do currently not apply, except for the limitations defined in RC-13.1.2.

FIFA LAW 17 - The Corner Kick

A corner kick is a method of restarting play.
A goal may be scored directly from a corner kick, but only against the opposing team.
A corner kick is awarded when

- the whole of the ball, having last touched a player of the defending team, passes over the goal line, either on the ground or in the air, and a goal is not scored in accordance with Law 10.

FL 17.1 Procedure (for Corner Kick)

- The ball is placed inside the corner arc at the nearest corner flag-post.
- The corner flag-post is not moved.
- Opponents remain at least 9.15m (10yds) from the ball until it is in play.
- The ball is kicked by a player of the attacking team.
- The ball is in play when it is kicked and moves.
- The kicker does not play the ball a second time until it has touched another player.

	**RoboCup Changes and Comments**
RC-17.1: Procedure	In RoboCup, the following procedure is used for a corner kick: • The referee gives a "stop" signal. • All players have to stop their movement. • The ball is placed inside the corner arc at the nearest corner to the position where the ball passed the goal line by the referee or one of the assistant referees. • The referee gives a "corner kick" signal. • The robot of the attacking team that is taking the kick is positioned at the ball. • All other players of the corner kick awarded team can stay anywhere on the field except in a circle with a radius of 2m around the ball until the ball is in play. • All players of the opponent team can stay anywhere on the field except in a circle with a radius of 3m around the ball until the ball is in play. One robot may stay anywhere inside the penalty area (except goal area) of its own team, even if the distance to the ball is shorter than 3m. • The referee gives a "start" signal. • A player of the team who was awarded the corner kick kicks the ball. • The robot taking the kick should either use its kicker or one of its sides to instantaneously kick (i.e., without dribbling or dragging) the ball such that it travels freely over a distance of at least 0.5m. • The ball is in play immediately after being kicked. • After the kick, the attacking team is only allowed to touch the ball a second time after it moved over a distance of at least 0.5m. • A goal may be scored only when the ball was touched by another player of the same team. • When 7 seconds have passed after the signal and the ball wasn't kicked by the attacking team, the defending team can intercept the ball and start normal play. • If a robot of the attacking team except the kicking robot approaches the ball before the ball is in play, a free-kick will be awarded to the other team.

	**RoboCup Changes and Comments**
RC-17.1: Procedure	It is forbidden to re-position robots by hand or by any other means with the only exception of the use of high level coaching of the robots (see FL 3.10, RC-Decision 2.1). The referee may show a yellow card to the robot that doesn't stay at least 2m (for the attacking team) or 3m (for the defending team) from the ball, following the referee's instructions. After that, if the robot doesn't follow the position restrictions of the procedure, the referee will show a second yellow card and the robot that received this card must be removed from the field for 90 seconds. The above mentioned 2m and 3m refers to the radius of a circle centered on the ball. The robots must be completely out of each circle respectively, depending on its status (attacking or defending). The referee must restart the game within 7 seconds after game stops with the exception for the autonomous substitution procedure defined in RC-3.5.

FL 17.2 Infringements/Sanctions

Corner kick taken by a player other than the goalkeeper

If, after the ball is in play, the kicker touches the ball a second time (except with his hands) before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.
- A penalty kick is awarded if the infringement occurred inside the kicker's penalty area.

Corner kick taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball a second time (except with his hands) before it has touched another player

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred.

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- A direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.
- An indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, the kick to be taken from the place where the infringement occurred.

For any other infringement:

- The kick is retaken

	**RoboCup Changes and Comments**
RC-17.2: Infringements/ Sanctions	In RoboCup, all clauses referring to situations, where the player taking the corner kick is touching the ball a second time, do currently not apply, except for the limitations defined in RC-13.1.2.

Chapter

Competition Rules

Competition Rules include:

- Competition Rule 1 - Team Qualification
- Competition Rule 2 - Referees
- Competition Rule 3 - Tournament Regulations
- Competition Rule 4 - Summary of Object Colouring
- Competition Rule 5 - Referee Box
- Competition Rule 6 - Normalized data structure
- Competition Rule 7 - Human player

COMPETITION RULE 1 - Team Qualification

CR 1.0 Admissibility of Team Qualification Procedures

The organizing committee of a tournament may limit the number of teams that are allowed to participate in the tournament for any of the following reasons:

- Scientific reasons, for example, when allowing more teams is likely to hurt scientific exchange and discussion or the overall scientific standard of the tournament.
- Space limitations are imposed by the site of the tournament.
- Time limitations are imposed by the overall tournament schedule.
- Any other kind of organizational constraint limits the number of teams that can be accommodated for.

In order to limit the number of participating teams, the organizing committee of a tournament may request teams to successfully complete a qualification procedure. The team qualification procedure shall be such that scientific progress and exchange is fostered.

CR 1.1 Team Qualification for RoboCup-2023

For RoboCup-2023, the team qualification procedure requires teams to submit the following material:

- A list of, at most, 5 scientific papers published during the last 5 years of the team which are related to RoboCup. A complete reference must be provided for each paper, including Title, authors, affiliation, Conference or Magazine name, editor (when applied), year of publication and pages of the procedures or magazine were it was published. Abstracts of these papers must also be submitted.
- Team Description Paper/Innovations of the team.
- A list of results and awards obtained by the team in the last 3 years.
- A video showing the capabilities of the team's robots.
- A list of contributions of the team to the RoboCup MSL community.
- Declaration if the team will be part of a mixed team.
- Declaration if the team requires 802.11b access-point.
- A mechanical and electrical description of their robots (e.g. by providing drawings) as well as a flow chart of the software structure.
- List of MAC Addresses used by the team, with explicit indication of those that will be used for wireless communication and their type: robots or development computers. All other MAC addresses will be blocked.

The material have to be submitted to the TC no later than that date defined by the OC in the "Call for Participation". Material arriving after this date will be not considered for the qualification process.

CR 1.2 Evaluation of the Qualification Material

The submitted qualification material will be evaluated by the MSL EXEC and TC. For each part of the submitted qualification material a number of points are awarded. These points are summed up per team. The teams are ranked as result of the collected points starting with the highest score. For the ranking of mixed teams the result of the best evaluated sub-team is used. Teams also may send their qualification material only once as one mixed team. Note that the qualification material points obtained by each team will also contribute to the scientific challenge final results (see scientific challenge in chapter F2000 Challenges).

Scientific results

Because RoboCup is primarily a scientific (not an entertainment) event, teams are strongly encouraged to submit technical papers to journals, major conferences and workshops. In particular, if a RoboCup tournament is associated or held in conjunction with a symposium, conference or a workshop, teams are strongly encouraged to submit papers to that event.

In order to decide if the 5 listed publications of the team are relevant for the MSL or RoboCup in general, the papers are reviewed by the TC. Papers have to be written in English in order to be evaluated.

Per accepted paper the following points are awarded:

- 8 points for a publication in an international journal or a book chapter
- 6 points for a publication at an international conference (peer-reviewed)
- 3 points for a publication at a national conference (peer-reviewed)
- 1 point for other publications (e.g., not peer-reviewed or PhD-thesis)

A factor of 0.5 is applied for publications that are not MSL related.
A maximum number of 40 points are awarded.

Performance in Past Events

A maximum of 40 points are awarded to a team for the performance in the last 3 years. If a team proceeds to the last 8 teams in a RoboCup world championship in the last 3 years 5 points are awarded to the team. If a team ranked top-3 in a RoboCup world championship in the last 3 years 10 points are awarded to the team. If a team is ranked among the best 3 in the Technical Challenge in a RoboCup world championship in the last 3 years 10 points are awarded to the team. If a team is ranked among the best 3 in the Scientific Challenge in a RoboCup world championship in the last 3 years 10 points are awarded to the team. If a team proceeds to the last 8 teams in a regional RoboCup championship (e.g., German Open, Dutch Open, Japan Open, US Open, Iran Open, China Open, Portuguese Open, Asia Pacific) in the last 3 years 5 points are awarded to the team.

Team Description Paper/Innovations

Teams have to describe their most innovative contributions or scientific results in a paper with up to 8 pages in the Springer LNCS style. If the paper is longer than 8 pages, then only the first 8 pages are evaluated. The content of the paper may comprise all topics related to RoboCup MSL or RoboCup in general (e.g. AI Planning, Vision, reinforcement learning, adaptive neural control, development of specialized hardware like sensors or processors for RoboCup, construction of innovative mechanical bases, self-localization, robot cooperation, team coordination, etc.).

If between $\frac{1}{3}$ and $\frac{2}{3}$ of the submission have been submitted before for a qualification, a factor of 0.75 is applied to the final score. If more than $\frac{2}{3}$ have been submitted before for a qualification, a factor of 0.5 is applied to the final score. Up to $\frac{1}{3}$ can be reused from previous submissions without penalty, for example to introduce the team.

The submission of a team description paper/innovations is mandatory for the qualification process. The paper will be reviewed by the members of the TC. Each member can award up to 20 points. Finally, the average over all evaluation will be awarded to the team.

Qualification Video

Teams have to submit a 60 second long qualification video. If the submitted video is longer than 60 second, then only the first 60 second will be considered for evaluation. The video should show that the robots of the team are able to perform at least the basic actions necessary for the RoboCup MSL. The requested actions are: dribbling the ball, avoiding obstacles, kick towards the goal, self re-positioning for a kick off, making a pass and a defending action of the goal keeper. For each of these actions which are shown on the video 2 points are awarded. For exceptional abilities, apart from those described above, each member of the TC can award up to 8 points. The average over all these evaluation plus the points of the necessary actions will be awarded to the team.

Contribution to the RoboCup MSL community

Contributions or service of the teams to the RoboCup MSL community are very important for the success of our league. Therefore, teams which actively serve for the community has to be honoured. Each member of the TC can award up to 10 points for the submitted list of contributions to the community. As contributions or service to the community count serving in league committees (EXEC, TC, OC), providing code for general use, e.g., the referee box, maintaining the league's homepage. The average over all evaluation will be awarded to the team.

Sharing of mechanical, electrical, and software design

A mechanical and electrical description of the robot must be provided. Up to 5 points can be obtained for each. If the material appears outdated, is incomplete, or is otherwise not easily usable by others, points can be deducted, proportional to the omissions, at the Technical Committee's discretion.

Another 5 points can be earned by publishing a high level documentation of the software (e.g., a flowchart). The same conditions apply for deduction of points as for mechanical and electrical description. External software tools (i.e., those that are not required for robot operation) may be left out of this documentation, but one is encouraged to include this.

Up to 15 points can be earned by publishing software source code. 2 of these points are awarded if the source code is clearly published under a license that allows others to use and modify the code free of charge. Up to 3 of these points can be earned by clearly referencing the components listed in the high level documentation in the published code. The final 10 points are awarded for the published code itself. Maximum points are awarded for published source code when it is:

- Complete. If it is impossible to publish some subcomponents of software due licensing, this should be clearly stated for each omission. Instructions should be included on how to obtain the missing software.
- Recent. At least the version of the software at the time of the last RoboCup tournament the team has participated in qualification for (and never older than 3 years), should be made available.
- Usable by others. Inclusion of instructions such that others know how to reuse components of the software. It is not required to publish a complete user guide for the software.

The Technical Committee determines to what extent these criteria are met, and may deduct points if it deems the publication incomplete. If the Technical Committee cannot verify the completeness of the software, and believes parts are missing, points may be deducted. Deductions are always proportional to the omissions.

CR 1.3 Minimum qualification criteria

For being able to participate in the RoboCup competition, teams have to ensure, at least, the minimum cumulative following criteria:

- Demonstrate in the video that they are able to perform the basic actions to be able to play;
- Produce a team description paper according to the above definition;
- Obtain a minimum of fifty points in the overall qualification procedure.

CR 1.4 Due Date, Submission, and Review of Team Qualification Material

All team qualification material must be submitted to the chair of the organizing committee for the Middle Size Robot League no latter than the date previously announced by the MSL OC in the Call for Participation.

The technical committee will review the material submitted as part of the qualification procedure and select teams for the tournament.

CR 1.5 Agreement on Open Source Development

For the benefit of scientific exchange, teams should make available technology and software developed for RoboCup as much as possible after a tournament has been played. To stimulate the sharing of information, points are awarded during the qualification of tournaments as described in the "Mechanical and electrical description of the robot and software flow chart"-section of CR 1.2.

COMPETITION RULE 2 - Referees

CR 2.1 Selection of Referees

Every team participating in a tournament must name at least two team members who serve as referees for matches **(this is mandatory)**. The named persons must have good knowledge of the rules as applied in the tournament and have to be able to lead a game in English. The persons should be selected among the more senior members of a team, and preferably have prior experience with games in the RoboCup MSL.

CR 2.2 Referee Assignment

The assignment of referees and assistants to matches is the task of the league organizing committee. A first selection of possible referees from all participating teams should be done during the registering phase of a tournament. Usually the OC ask all teams to send lists of referee volunteers.

One referee and at least one assistant will be assigned for judgement of a match. The league organizing committee may choose to assign more assistants. The recommended number is one main referee, one assistant referee and two goal assistants.

Assistants can be assigned specific tasks, like handling the stop watch, ensuring the absence of manual interference by team members, and such. It is recommended that the assistant referee takes care of timing, taking notes on cards shown, and filling out the referee game sheet. The duties of the goal assistants is to check the occurrence of goals and survey the timing rules regarding robots in the goal area.

If either a referee or an assistant assigned to a match cannot fulfil his duty for some reason, he has to inform the organizing committee as soon as possible, give the reason for his inability to fulfil his duty, and request a replacement to be named.

CR 2.3 Referees during Match

The referee and assistant referees should wear black clothing/shoes and avoid reserved colors for the field, and player markings in their clothing.

The referee and his assistants will be close to but off the field during play. The referee should take a position at some distance to team areas. The referee may order team members to maintain positions at an appropriate distance.

The referee and the assistants may enter the field in particular situations, e.g. to re-position the ball when the game gets stuck, but only if the ball is too far away from the desired position or on an offending position (e.g. inside a penalty area). Furthermore, when a drop-ball is awarded in a game stuck situation, the referee should not be required to re-position the ball - the robots should be able to move away from the ball without grabbing it.

The referee and his assistants should avoid to interfere with robots as much as possible, unless a robot is threatening to cause serious damage to people, other robots, or other equipment.

The referee may order team members onto the field in order to remove a robot. Orders by the referee have to be executed promptly.

The referee may allow members of a team to enter the field, in particular during game stoppages. No team members are allowed to enter the field or to interfere otherwise with the game process unless permitted or ordered by the referee. Exceptions to this Competition Rule are established in RC-5.3.2.

CR 2.4 Infringements/Sanctions

A team failing to meet its refereeing duties, either by not naming appropriate persons to the organizing committee or by the assigned referee not fulfilling his duties, is subject to penalties decided upon by the

organizing committee of a tournament.

Penalties may include fines, to be paid immediately before the team's next match, or exclusion from the ongoing or future tournaments.

COMPETITION RULE 3 - Tournament Regulations

CR 3.0 Preliminary Remarks

In order to provide a good opportunity to gain match experience, the tournament plan shall be designed such that all teams can play as many games as possible.

CR 3.1 Parts of the Competition

The RoboCup competition consist of the following parts:

- Team Registration, Setup, and Technical Inspection
- Technical Evaluation Rounds to assign Scientific and Engineering Awards and define groups for tournament
- Preliminary Rounds (Round-Robin)
- Playoffs

Every team that is admitted to the tournament must participate in all parts of the competition. Teams that, for any reason, may no longer be actively participating in the games, will still have to serve as referees and for various other duties. Teams failing to serve the duties they have been assigned to may be excluded from future tournaments.

CR 3.2 Team Registration, Setup, and Technical Inspection

Every team has to set up and register on site at least 24 hours before the first game of the tournament is scheduled.

The Middle Size League Committee **strongly recommends** arriving no later than 48 hours before scheduled games start.

It is the sole responsibility of the teams to plan transport of equipment and travel of team members such that both arrive on time. Teams should carefully take into account any potential visa and/or customs problems that may arise.

Teams which did not personally register on site at least 24 hours prior to the first scheduled game may be excluded from the tournament.

Teams excluded from the tournament because of showing up late are not eligible to a refund of registration fees or any other kind of expenses. Neither the RoboCup Federation, nor the local organizers, nor anyone else involved in organizing a RoboCup tournament can be held liable for any cost, or damage suffered, by teams excluded from the tournament.

Team shall set up their robots and equipment and make any adjustments to local conditions well before the first game starts.

During setup, teams should use the field only when necessary, and only for shortest possible times. The League Organizing Committee may impose restrictions on the use of fields during setup and install special procedures for obtaining access to the field.

The Middle Size League Technical Committee will organize a technical inspection of robots during the setup phase. Currently, the following procedure will be followed:

1. All robots will be photographed or filmed during technical inspection.
2. Size, shape and weight constraints will be checked during the technical inspection.
3. Compliance with the connection to the referee box and field AP will be checked. Also maximum emitted power by robots WiFi equipment will be tested according to RC-4.2.5.

4. Compliance with ball handling limits (RC-12.0.1) will be checked.
5. Once technical inspection is over, additional checks occur only if someone assumes some physical change to a robot. Objections may be raised only up to 10 minutes before the game starts and only by a team leader.
6. The opponent team must permit inspection of robots for 10 minutes, from 20 minutes to 10 minutes before game start.
7. No objections will be taken later on.

Note: Details of technical inspection are subject to changes by the League Technical Committee at any time, depending on the situation or requests by a team leader meeting on site.

Consequences of Technical Inspection Failure

It is a fact that these rules exist due to safety concerns and also to maintain a certain level of fairness between teams. Therefore, teams that will be violating them on the RoboCup 2023 competition will have a penalty, depending on the type of violation. Penalties are cumulative and are applied as follows:

- **Max. Weight 40 Kg** (measurement tolerance of 1Kg) - start each half with a robot out for 2 minutes per extra Kg
  - >41 Kg = 1 robot out for 2 minutes
  - >42 Kg = 1 robot out for 4 minutes
  - ...
  - >47 Kg = 1 robot out for 14 minutes
  - >48 Kg = 1 robot out for 15 minutes + another robot out for 1 minute
  - etc.

  This is applied to every half. For example, if a team has 45.5Kg, they must start both the 1st and 2nd half with 1 robot less, and can bring that robot inside the field 10 minutes after the start of the respective half period. The heaviest robot of the team is used for this purpose.

- **Max. Size** $52 \times 52 \times 80$ **cm** (tolerance 1 cm for width+depth, 0.5cm for height)
  - Field players:
    - Exceeding a measurement = 1 robot out for each 2cm
    - width or depth >53 cm = 1 robot out
    - width or depth >55 cm = 2 robot out
    - height >80.5 cm = 1 robot out
  - Goalkeeper:
    If exceeding a measurement, it must be replaced with a robot which is inside the limits. If no other robot is inside the limits, team has to play without goalkeeper Please pay special attention to moving parts - the default limits of the goalkeeper can only be surpassed (under the restrictions expressed on the rules) for 1 second, with a minimum waiting time of 4 seconds to surpass the limit again. Teams must ensure that all the limits (both default and extended) are not surpassed, otherwise the robot is not compliant and can't play.

- **Ball handling** (tolerance 0.5cm)
  A ball marked with 1/3 of its diameter will be used to verify the limits of the ball handlers. Teams must ensure that the limit is not surpassed, otherwise the robot is not compliant and can't play.

Any violation will be published on the public MSL website (https://msl.robocup.org/) with the team name and the respective violation(s). If a team fails inspection for one year, they have to fix the problem for the following year, otherwise they become disqualified.

CR 3.3 Technical Challenge

In order to promote the scientific goals of RoboCup and an according team attitude, the Middle Size League Committee will give recognition to specific scientific and engineering achievements tested by challenge competitions, as described in F-2000 Challenges.

Number and character of awards will be determined in accordance with the Executive Committee of the RoboCup Federation.

Mandatory and free challenges are identified in F-2000 Challenges.

CR 3.4 Preliminary Rounds

For the preliminary rounds, teams will be assigned to groups.

The number of groups will be determined by the League Organizing Committee, which takes into account the number of qualified teams as well as site and schedule constraints of the tournament.

The ranking for the initial organization of the groups that will participate in the competition will be done according to the following rules:

- For teams that have participated in the previous RoboCup edition, the final classification will be used;
- Teams that did not participate in the previous RoboCup edition will be ranked, after the previous ones, according to pre-qualification results.
- If a tie persists among one or more teams a draw will be performed. Team leaders must be present during the draw procedure.

Each group will play a single round of round-robin matches, i.e. each team will play once against every other team in its group.

As a guideline, every team should be prepared to play as many as eight (8) games within two days.

During the preliminary rounds, a match ending in a draw will NOT be decided by a penalty shoot-out.

The winner of a match will be awarded three points, the loser will be awarded no points. If a match ends in a draw, each team will be awarded one point.

All points awarded to a team are added up.

Teams are ranked within their group by the points they gained during the preliminary round. If two or more teams have the same number of points, a decision is based upon the following criteria, in the order given:

1. Number of actually played games (see CR 3.6 and CR 3.7).
2. Goal difference.
3. Absolute number of goals achieved.
4. Result of direct match-up.
5. Result of technical challenge between tied teams.

Note: Depending on competition factors such as number of teams, number of fields and availability of the venue during the night, the organizing Committee may decide on how to organize the next preliminary rounds after the first round robin.

The best eight teams of *all* groups qualify for the play-offs.

We assume the number of groups m to be less than eight. Then the first $8/m$ (rounded down to the next lower integer) teams in each group are qualified for the play-offs.

If eight is not a multiple of the number of groups m, then wild-card games may be played to determine the teams for remaining spots in the play-offs. Details will be announced prior to the tournament.

This schedule construction may be subject to changes of the League Organizing Committee due to the number of participating teams, the site and schedule constraints of the tournament and the principle of maximizing the number of games for each team. If the schedule is subject to changes this will be announced prior to the beginning of the tournament.

CR 3.5 Play-offs

The play-offs consist of quarter finals, half finals, and finals matches. Every play off round is decided by a single match (best-of-one). If, by decision of the League Organizing Committee, only four teams dispute the play-offs, then the play-offs consist only of half finals, and finals matches

A plan of play-off matches will be made available by the organizing committee before start of the tournament.

If play-off matches end in a draw after the regular match time, an extra 10 minutes extra time will be played. This extra time is divided into two 5 minutes halves with no interval time. If the extra time still ends in a draw, the game must be decided by playing a penalty shoot-out. If play-off matches are still drawn after a penalty shoot-out, the penalty shoot-out will be repeated and after another draw the match will be decided according to the following set of priority rules:

- the team with the best goal difference in the tournament so far, wins;
- the team that made most goals in the tournament so far wins;
- the team that performed best during the technical challenge wins;
- the team that performed best at the scientific challenge wins.

CR 3.6 Appearance at game start: forfeiting

According to trustees recommendations, the concept of forfeit is introduced in the rules.

Forfeiting is defined as refusing to make a good faith effort to participate in a scheduled game.

A team that forfeits can be disqualified from the competition. It is up to the OC and EXEC together to assess if a team is forfeiting.

If a team does not show up at the beginning of a game for valid reasons, or is in no technical conditions to play the game, a victory will be awarded to the opponent team with a score of 3-0. This game is accounted as played for the winning team but will not be accounted as played for the team that does no show up.

CR 3.7 Withdrawal from game

If a team withdraws from a game after it started for any reason that is considered valid by the OC and EXEC, a victory will be awarded to the opponent team, either by adding three goals to its current score, or by adding the necessary number of goals to ensure a minimum difference of three goals. This game is accounted as played for the winning team but will not be accounted as played for the team that is withdrawing.

COMPETITION RULE 4 - Summary of Object Colours

Here is the list of colors for objects on the field (surface, field boundary, goals and robots):

Object	Colour
Field surface	GREEN
Field safety boundary	BLACK
Lines on the field	WHITE
Goals	WHITE
Robot bodies	BLACK
Markers of robots for team A	See below.
Markers of robots for team B	See below.

Regarding robot markers, they can by of any saturated color, excluding BLACK, WHITE, GREEN and the color of the ball. Please refer to **RC-4.2.4.1** for more information.

Note: During the setup days each team must provide the OC with a sample of each of the two color markers they plan to use, such that the OC can prescribe in the competition schedule which marker each team has to use (preventing two teams with the same color on the field).

COMPETITION RULE 5 - Referee Box

The official referee box is available at:

- https://github.com/RoboCup-MSL/

It is mandatory for all teams to use this referee box. In case a new version of the referee box is made available until two months before the tournament, then this new referee box will be used. Teams will be individually notified in this case.

COMPETITION RULE 6 - Normalized data structure

In order to facilitate ad-hoc mixed teams and to log relevant data for benchmarking and machine learning purposes, RoboCup MSL works towards standardized data representation.

A description of both (1) the standardized data package for inter robot communication and (2) instructions for world state logging via the refbox pc is available via the RoboCup MSL website:

- https://msl.robocup.org/requirements.

The world state logging document contains a description of two JSON packages, one for events and one to describe the current game state. Teams are required to push the latter message at least ten times per second from the basestation pc to the refbox pc via the same TCP/IP connection that is also used for referee commands. Event log messages can be pushed whenever an event, defined by the team itself, occurs.

Both standardization documents can be updated by the TC until two months before the RoboCup World Championship. Teams will be notified of any changes made.

Teams participating in standardized logging will be rewarded with additional points for the scientific challenge (Challenge 2). Log-files will be made available directly after the match.

For teams that participate in RoboCup MSL for more than two years, this world state logging is mandatory. Younger teams are not required to send world state logging, but they will not be awarded additional points for the Scientific Challenge.

COMPETITION RULE 7 - Human player

One human player can substitute a robot player in a match. They can do this either through a substitution (RC-3.5), or at the end of a repair timer (RC-4.5.1). All rules in this rulebook apply to the human, also where there are references to 'robot'. Several alterations are made for the human:

1. RC-4.2.0 (robot size), RC-4.2.1 (robot shape), RC-4.2.2 (robot weight), RC-4.2.4.3 (top marker) do not apply. Note that humans need to wear markers of the same color as their robots, visible from every side, satisfying RC-4.2.4.1.

2. For safety, the equipment of a human player (FL-4.2) is instead specified as at least:

   - Jersey
   - Trousers that cover up the ankle, and do not drag on the ground
   - Shinguards that cover all sides of the lower leg, both shin and calf
   - Footwear, fully closed up to the ankle, without spikes, and solid (i.e. can protect the wearer from the impact of a robot)

   Additional, non-safety constraints on the equipment apply as specified in the rulebook. A referee can refuse the human access to the game in case they deem the equipment unsafe for human or robot.

3. The safety border described in RC-4.1 must be increased to 5cm thick, and 20cm high when playing with humans. The minimum and maximum sizes in RC-4.2.0 must be updated accordingly, such that the size restrictions for a robot without safety border do not change.

4. Teams must add protection to sharp corners and edges of the robots.

5. A human who receives a yellow or red card has to be removed from play with a repair timer, and the team cannot use a human player for the remainder of the match.
6. The human may not get an unfair advantage through moving faster than walking speed.
7. The ball can only change ownership between a human and another player through a pass, or when rolling freely.
8. The human player cannot walk or dribble when in possession of the ball.
9. The human player cannot shoot at goal. This also means they cannot perform a penalty kick. Doing so results in a yellow card.
10. The human player cannot be goalkeeper.
11. The human can be substituted according to RC-3.5, the assistant referee will enter the human's number (as indicated by their marker) in the RefBox. A human can also be taken out of play using RC-4.5.1. A human can re-enter the game as specified in the respective rules.
12. The human must be registered as a team member for the tournament.
13. Liability of injuries fully falls on the team of the human player. The RoboCup Federation, the tournament organization, and opponent team cannot be held liable for injuries sustained by a human player.
14. Teams need to indicate their ability to safely play with humans before each match. Humans can only be used if both teams indicate this ability.
15. The MSL Technical Committee (or in their absence, the tournament organization) has the right to impose additional constraints during a tournament to ensure fair and safe games.

COMPETITION RULE 8 - Rules Updating Time Out

If the TC doesn't provide updated rules for the next tournament by December 31st, the existing rules of the last tournament will apply.

Chapter

F-2000 Challenges

For RoboCup 2023, two challenges have been selected as mandatory: Challenge 1 - Technical Challenge and Challenge 2 - Scientific/Engineering Challenge. All teams participating in the tournament have to take part in these challenges. A team that does not participate in any of the challenges can be disqualified from the tournament. All results in the tournament will be canceled.

For RoboCup 2023, one challenge has been selected as optional: Challenge 3 - Ambition Challenge. Teams who satisfy the requirements can indicate during qualification if they want to participate in this challenge.
Teams not participating in the tournament are welcome to participate in the challenge competitions.
The winner of each of the challenge competitions will be awarded a prize for his achievement.
A list of proposals for other challenges to be used in the future is also presented.

Challenge 1 - Technical Challenge

The technical challenge is composed of two components. The first part is the demonstration of a new concept and the second part is the logging of match data. Each of these components will be explained in the next paragraphs. The total score of the technical challenge will be the sum of the demonstration and the data-logging.

CR 1.1 Demonstration of New Concept

Within a time frame of 10 minutes, teams demonstrate one solution each, which contributes towards the RoboCup 2050 objective. Although presentations are allowed for explaining the approach, the focus of the Technical Challenge will be on demonstrating the concept. As such, teams are obliged to demonstrate their concept: no score is obtained if there is no demonstration. The judgement will take into consideration the following specific issues, each one of which will be granted between 1 and 10 points

- Criterion 1 (C_1): Roadmap compliant (For example: mix team protocol, human compliant (safety!), solutions related to futsal-sized field, arbitrary ball, active hands of keeper, automatic referee, solutions for cost-reduction of soccer platform.)
- Criterion 2 (C_2): Open sourceness and adoptability of solutions for other teams
- Criterion 3 (C_3): Demonstration of concept
- Criterion 4 (C_4): Level of advancement, i.e. the level of technological progress
- Criterion 5 (C_5): Level of reliability and robustness
- Criterion 6 (C_6): (Potential) impact on the game
- Criterion 7 (C_7): Novelty

The score S awarded by team leader a for the technical challenge of team b is determined according to the following weighting:

$$S_{a,b} = 2C_1 + 2C_2 + 3C_3 + 2C_4 + C_5 + 2C_6 + C_7$$

- A team does not judge their own work, i.e. $S_{a,a} = 0$.

- The average of the scores given by a team leader (TL_a) will be calculated for all n teamleaders:

$$TL_a = \sum_{b=1}^{n} \frac{S_{a,b}}{n}$$

- Next we will average over the number of team leaders:

$$AVG = \sum_{a=1}^{n} \frac{TL_a}{n}$$

- In order to normalize the scores, each of the team leader ratings will be multiplied by the ratio:

$$R_a = \frac{AVG}{TL_a}$$

$$NS_{a,b} = S_{a,b} \cdot R_a$$

- The resulting normalized ratings will be summed to obtain the final score of the technical challenge:

$$FS_b = \sum_{a=1}^{n} NS_{a,b}$$

CR 1.2 Data-logging

The score for participation in standardized data logging (SC_{dl}) will be obtained as follows:

$$SC_{dl} = \frac{NL}{NLO} * 10$$

with NL being the number of valid full-match logs the team produced since the previous Technical Challenge and NLO the Number of Log Opportunities, being the number of matches the team played on a RoboCup World Championship since the previous Technical Challenge. In case $NLO = 0$ the score for data logging will be zero ($SC_{dl} = 0$).

Challenge 2 - Scientific/Engineering Challenge

In this challenge teams are free to show one significant achievement each, and all the other team leaders from teams participating in this challenge will evaluate them. Teams can take at most 10 minutes to show their achievements. Achievements in the list of proposal challenges that follows are encouraged but are not limited to them. The judgement will take into consideration the following specific issues, each one of which will be granted between 1 and 10 points:

- Presentation
- Novelty
- Interest for either the present or the future of the league
- Scientific/Technical complexity
- Scientific relevancy for the league
- Importance of demonstrated experimental results
- Relevance of the published results presented as a support for this challenge

On top of the score for the presentation (FS^{pr}), additional points can be obtained via the qualification procedure (FS^{qs}). The score for the presentation is obtained as follows:

- The score given by team leader a for the presentation of team b is $S^{pr}_{a,b}$. A team does not judge their own work, i.e. $S^{pr}_{a,a} = 0$.
- The average of the scores given by a team leader (TL_a) will be calculated for all n teamleaders:

$$TL_a = \sum_{b=1}^{n} \frac{S^{pr}_{a,b}}{n}$$

- Next we will average over the number of team leaders:

$$AVG = \sum_{a=1}^{n} \frac{TL_a}{n}$$

- In order to normalize the scores, each of the team leader ratings will be multiplied by the ratio:

$$R_a = \frac{AVG}{TL_a}$$

$$NS^{pr}_{a,b} = S^{pr}_{a,b} \cdot R_a$$

- The resulting normalized ratings will be summed and divided by the number of teams to obtain the final presentation score:

$$FS^{pr}_{b} = \sum_{a=1}^{n} NS^{pr}_{a,b}/n$$

- The component from the pre-qualification process (FS^{qs}) is composed of:
  - the average Team Description Paper-score (SC^{TDP}, maximum 20 points) as assessed by the Technical Committee
  - the Scientific results (SC^{sr}, maximum 40 points) obtained in the qualification
  - the score obtained during qualification for sharing mechanical, electrical and software descriptions (SC^{share}, maximum 30 points)

Hereby, members of the Technical Committee can not asses their own team.

The scores are weighted such that SC^{TDP} is 46% of FS^{qs}, SC^{sr} is 31% of FS^{qs}, and SC^{share} is 23% of FS^{qs} according to the following formula:

$$FS^{qs} = (SC^{sr} + 3SC^{TDP} + SC^{share})/13$$

The final score (FS) for team b will then be obtained by the sum of the pre-qualification process and the presentation score

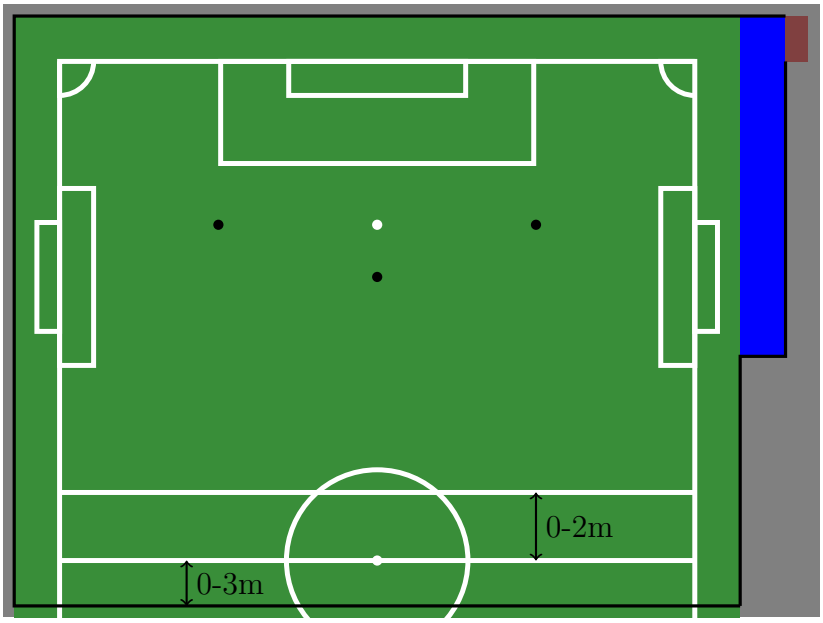
$$FS_b = FS_b^{pr} + FS_b^{qs}$$

Challenge 3 - Ambition Challenge

This challenge is designed for teams with little recent experience competing in RoboCup Middle Size League, and intended as a step to participate in the full competition. This challenge reduces the participation requirements of the standard MSL competition, allowing teams to already play matches even if robots do not meet all the requirements of the standard competition yet.

Referees are encouraged to be lenient toward the teams, focussing on *playing* matches, while still ensuring safety and fairness. The rules of the challenge are a modified form of the official MSL rules:

- Tournament
  - Only teams that have participated less than 2 times in the MSL tournament or *Ambition Challenge* out of the last 4 MSL tournaments are allowed to participate (i.e., if teams participate every year, they can join the Ambition Challenge twice).
  - In order to qualify, teams do *not* need to obtain 50 percent of the points in qualification. Teams are still required to submit a Team Description Paper and a qualification video.
  - This challenge will only take place when at least 2 teams participate.
  - One full round robin is guaranteed to be played. More matches are possible, but depend on availability of a field. Play-off rounds may also be played.
  - Teams have 5 minutes preparation time before matches. If teams are not ready, the match time is reduced accordingly.
  - One match takes 10 minutes (clock time). There is only a single half, with no compensation for lost time (RC-7.3). There is also no extra time (CR 3.5). In case penalty kicks are necessary in a play-off round to determine a winner, these are taken from the center marker of the challenge field.
- Field



  - RC-1.1: The field used for this challenge is half of a standard MSL field. One of the touch lines is moved inwards from the MSL middle line by 0-2 m, resulting in a field of 14m $\times$ 10 $\pm$ 1m. Two standard MSL goals are placed on each side of the field, halfway at either shorter side. The figure above shows a possible layout of a field.
  - RC-1.2: Field lines are those of a half standard MSL field, with the exception of an additional touch line. Consequently, there is no central line on the field, but an additional central point will be added for locating more easily kick-off position.

  - RC-1.2 addition: It is allowed, but strongly discouraged as these are not allowed in the main MSL competition, to add some active or passive positioning systems in order to aide robot positioning. Any additions must be placed on or up to 1 meter outside of the safety barrier. The organization cannot guarantee that there is room for these systems everywhere around the field. If there is another match on the other half of the MSL field, no systems may be placed on that side of the field. Teams must be able to add this hardware within the preparation time, and remove it before the next match starts.
  - RC-1.2.1: The existing safety borders of the MSL field are used, as well as an additional border placed on or at most 3m behind the MSL middle line. There will always be at least 1 meter between the touch line and safety barrier.
  - RC-1.3: Additional goal areas are drawn on the challenge field. As these are added manually, please account for some variance in their position.
  - RC-1.2.4: There is no guarantee that a Technical Area is available.

- Players
  - RC-3.1: A match is played by two teams, each one consisting of not more than 3 players, one of whom can be the goalkeeper. A match may not start if either team consists of fewer than two players. If the number of players in one team is less than 2, the match must be forfeited.
  - RC-3.1 addition: Humans are not allowed to play in this challenge.
  - RC-3.5: It is not possible to use substitutions.
  - Decision 2.1: It is not allowed to use voice coaching.
  - RC-4.2.4.1: The color markers must be exactly 10cm by 10cm, resulting in mostly black robots. Different colors are allowed for the markers, but cyan and magenta are encouraged.

- Communications
  - RC-4.2.5: Communication bandwidth is not limited, but teams are advised to respect official bandwidth limitation in order to be able to compete in standard MSL competition.
  - RC-4.2.5: There is no RefBox, teams must be able to send all required commands from their base station. A check will be performed to ensure that all teams are capable of sending these messages.
  - RC-4.2.5 addition: It is recommended to add a radio emergency switch for switching off the motors and actuators, allowing to stop robots in case of an unexpected behaviour.
  - RC-4.5.1: There is no timer when a robot is taken out for repair. A robot can be added at the next stop signal.

- Set-play procedure
  - RC-8.2: The attacking team may not score a goal directly from kick-off without an (attempted) pass. The robot obtaining first control of the ball during a kick-off has to attempt a pass to a different player before a goal can be scored.
  - RC-13.4.1, RC-14.1, RC-15.1, RC-16.1 and RC-17.1: The positioning constraints are simplified. One player of the attacking team can position at 1m from the ball. Every other player can position anywhere at least 3 meters from the ball. Robots need to hold their position after the start signal according to the original rules.

- Method of Scoring
  - RC-10.1.1: A goal can be scored without making a pass before, with the exception of the kick-off (see above, Set-play procedure).
  - RC-10.1.1: Double points are awarded for a goal scored after a pass. What constitutes a valid pass is described in RC-10.1.1.

- Fouls and Misconduct

- RC-12.0.1: Dribbling distance is not limited, but respect of the MSL standard rules is encouraged in order to be able to play in normal conditions.
- RC-12.2 and RC-14.4: There is no in-game penalty kick in the *Ambition Challenge*.
- RC-12.3.1: It is not required for the ball to roll in its natural direction. However, the ball may not be held tightly such that it is not able to roll.
- RC-12.3.4 and RC-12.3.5: There is no time limit for staying in the penalty area. There is also no limit on the number of robots in the penalty area.
- RC-14.3: End-of-game penalties only occur for play-off matches. The ball is positioned on the center mark of the challenge field.

These Ambition Challenge rules can be adapted by the TC during a competition in order to ensure fair games.

The Technical Committee encourages new teams to contact them with any questions about this challenge or the league in general.

Other Challenges that can be used in Future Tournaments

Beyond the previously described challenges the following list is currently regarded as proposals. All teams are invited to contribute their ideas in order to add new challenges or further improve existing challenges.

Challenge 4 - Skill Tests

The aim of this challenge is to encourage teams to:

- Improve their basic soccer skills;
- Work on shoot accuracy;
- Localize and perceive the environment with obstacles of unknown saturated colors;
- Work on ball control to dribble with obstacles;
- Assess risk and optimize the time usage to maximize score.

This challenge requires two active robots, uses a minimum of four different obstacles and will take place in the official MSL field. This challenge is disputed in 2 runs. The total score will be a sum of final score of each run. And for each run, the final score will be the maximum earned points among all attempts considering the number of attempts. That means for each run, the final score will be compute by the following formula:

$$FinalScore = MaxPoints \times (1 - (NumberOfAttempts - 1) \times 0.1),$$

where $MaxPoints$ is the maximum earned points in a run, among all runs.

For example, a team with 4 attempts in this order: 1^{st} try = 10 points, 2^{nd} try = 25 points, 3^{rd} try = 8 points, 4^{th} try = 0 points, has $25 \times 0.7 = 17.5$ points as the overall final score by 4 attempts.

If a tie exists among one or more teams, the number of attempts are used to sort the final ranking (less is better). If a tie persists again, total time of all attempts will be used (less used time is better). If a tie persists again, the results of the qualification ranking will be used. If the results of the qualification ranking are not sufficient to rank teams, a regular penalty shoot-out will be performed until there is a winner.

CR 4.1 Run #1 - Skills on static field and colored obstacles recognition

PRESET:

- Regular setup for the match will be used (WiFi AP will be turned on)
- The participating team provides two robots and a visualization tool showing robot self-localization and recognized obstacles in a 2D coordinate-system.
- A minimum of four different obstacles are available, meeting the following criteria:
  - Approximately the size of an MSL robot (min 40x40x60cm, max 50x50x80cm)
  - Obstacles are of saturated single color.
  - Green, white, black and the color of the ball are excluded as valid obstacle colors
- One robot is placed on the center of the field and another robot is placed in the own side penalty marker.
- The team-leader of the team chooses if the official tournament ball or an arbitrary ball is used.
- The ball is placed on one of the restart-points, as chosen by the team-leader.
- Four obstacles will be randomly selected and randomly placed in the field.

PROCEDURE:

- Maximum duration: Floating 5 minutes in total 10 minutes. (Each team has 10 minutes for technical challenge run#1. But only 5 minutes of this duration is considered as they time and they have 5 minutes for setup. If they need more time for setup, that means they have less time for run).
- During the duration of the run, the team is free to demonstrate the skills present on the table below (see scoring) in any order. But for localization points, they need to show and report final positions in their visualization tool at the end of each attempts. So the visualization tool should be able to show and report positions when robots are stopped for any reason.
- The robot must be able to grab the ball and move it autonomously (With full compliance of the RC-12.0.1 Ball Manipulation). No human intervention allowed.
- If at least one of the following situations occur, the team needs to stop the robots and the current time will be considered for the total time if they say this attempt was the last attempt:
  - Team explicitly requests to end the run
  - A robot goes out of the field (with exception for skill 3 - when scoring a goal, and ball remained inside the goal, inside the goal will be considered as inside the field)
  - A robot touches one of the goals
  - The official ball or the arbitrary ball goes out of the field (with exception for skill 3 - when scoring a goal, inside the goal will be considered as inside the field)
  - Both robots standing still for more than 10 sec
  - A robot hits any of the obstacles with its body
  - When ball holding (RC 12.3.1) or other offence on the rules occurs

SCORING:

		Points (normal ball)	Points (arbitrary ball)	Max Points
Skill 1	Make a low pass	1	3	9 (3 passes)
Skill 2	Make a lob pass	3	10	30 (3 passes)
Skill 3	Score a goal	2	5	15 (3 goals)
Skill 4	Hit the goal bar	5	14	42 (3 hits)
Skill 5	Hit the goal post	4	12	36 (3 hits)
Skill 6	Show Obstacle Position	1	1	4 (4 obstacles)

- Passes (skills 1 and 2) are valid if:
  - Ball travels at least 2 meters.
  - The receiver robot can grab the ball.
  - Ball doesn't hit or touches any of obstacles during travel.
- A pass is considered a lob pass (skill 2) when the height of the ball clearly goes above 80 cm. Otherwise, it will be considered a low pass (skill 1).
- A goal (skill 3) is only valid if:
  - A robot gets the ball afterwards. If the ball enters the goal but the run stops for any reason, no point is awarded.
  - The ball was kicked from outside the penalty area.
  - Hitting the goal crossbar or post (skills 4 and 5) are only valid if:
  - A robot gets the ball afterwards. If the ball hits the goal crossbar or post but the run stops for any reason, no point is awarded.
  - Ball was kicked from outside the penalty area
- In case of doubt if the ball hit the crossbar or post, it will be considered hitting on the crossbar.
- In case of doubt, if the ball hit the crossbar or post and go to the goal (skill 3 with skill 4 or skill5), it will be considered hitting the goal (skill 3).
- For each obstacle localized in the correct position (±50cm for each coordinates are acceptable), one point will be awarded (Maximum 4 points in each attempt).
- Recognizing the correct color of the individual obstacles is not part of the challenge.
- There are two balls in the field (the normal one and the classic one), robots can do skill 3, 4 and 5 at the same time (in any side of the field), but the maximum number of each skill is 3.
- The minimum number of points in this technical challenge run is zero.

PENALTIES:

- Every contact of any of the active robots with an obstacle will be punished with a point, which is subtracted from the amount of points in the current run. Furthermore, the procedure must be interrupted and restarted from point 1.
- If the ball or an arbitrary ball goes out the field delimiting lines at any time, the team will be punished with a point which is subtracted from the amount of points in the current run. Furthermore, the procedure must be interrupted and restarted from point 1 (with exception for skill 3 - when scoring a goal, inside the goal will be considered as inside the field).
- If any of the robots moves out of the field delimiting lines, one point will be subtracted from the amount of points. Furthermore, the procedure must be interrupted and restarted from point 1 (with exception for skill 3 - when scoring a goal, and ball remained inside the goal, inside the goal will be considered as inside the field).

CR 4.2 Run #2 - Dribbling static colored obstacles

PRESET:

- Regular setup for the match will be used (WiFi AP will be turned on)
- The participating team provides one robot.
- A minimum of four different obstacles are available, meeting the following criteria:
  - Approximately the size of an MSL robot (min 40x40x60cm, max 50x50x80cm)
  - Obstacles are of saturated single color.
  - Green, white, black and the color of the ball are excluded as valid obstacle colors
- The robot is placed in the own side penalty marker.
- The ball is placed on the center of the field.
- Four obstacles will be randomly selected but they will placed on the specific points in the field (according to MSL standard coordinates), in meters:
  $(0 \pm 0.2, 2 \pm 0.2); (0 \pm 0.2, 3.8 \pm 0.2); (0 \pm 0.2, 5.6 \pm 0.2); (0 \pm 0.2, 7.4 \pm 0.2);$

PROCEDURE:

- • Maximum duration: Floating 3 minutes in total 5 minutes. (Each team has 5 minutes for technical challenge run#2. But only 3 minutes of this duration is considered as they time and they have 2 minutes for setup. If they need more time for setup, that means they have less time for run).
- During the duration of the run, the team is free to demonstrate the skills present on the table below (see scoring) in any order.
- The robot must be able to grab the ball and move it autonomously (With full compliance of the RC-12.0.1 Ball Manipulation). No human intervention allowed.
- If at least one of the following situations occur, the team needs to stop the robots and the current time will be considered for the total time if they say this attempt was the last attempt:
  - The robot goes out of the field
  - The robot touches one of the goals
  - The ball goes out of the field
  - The robot standing still for more than 10 sec
  - The robot hit any of the obstacles by its body
  - When ball holding (RC 12.3.1) or other offence on the rules occurs.
    - The ball should rotating in its natural direction of rotation, and movements of the ball such as "roll-stop-roll-stop" will be considered as ball holding.
    - Dribbling with direct contact between the robot and the ball outside of circle with a radius of three meters (has been explained in RC 12.0.1) will be considered as ball holding.
  - Dribbling backward with direct contact between the robot and the ball for more than 2 meters.

SCORING:

Dribble Type	Description	Points per dribble	Max Points
Forward	Dribble forward for at least 1 meter	1	5
Backward	Dribble backward for at least 1 meter	2	6
Slalom	Dribble 4 obstacles in a slalom form	4	24 (6 complete parcours)

- A forward or backward dribble is valid if:
  - Direct contact between the robot and the ball considered for more than 1 meter.
  - The robot moves forward or backward with full compliance of the RC-12.0.1 (Ball Manipulation).
  - The robot or the ball does not hit or touches any of obstacles during travel.
- For doing a single forward or a single backward dribble, the robot needs to release the ball each time.
- A slalom-dribble is considered as making a "s"-shaped pattern between the objects, i.e. one object is passed on the right side of the robot, while the next object is passed on the left side of the robot and vice versa. A slalom dribble is valid if:
  - The robot move forward/backward with full compliance of the RC-12.0.1 (Ball Manipulation).
  - The robot or the ball does not hit or touches any of obstacles during travel.
- Forward and backward dribbles can be demonstrated while doing the slalom dribble.

PENALTIES:

- Every contact of any of the active robots with an obstacle will be punished with a point, which is subtracted from the amount of points in the current run. Furthermore, the procedure must be interrupted and restarted from point 1.
- If the ball goes out the field delimiting lines at any time, the team will be punished with a point which is subtracted from the amount of points in the current run. Furthermore, the procedure must be interrupted and restarted from point 1.
- If any of the robots moves out of the field delimiting lines, one point will be subtracted from the amount of points. Furthermore, the procedure must be interrupted and restarted from point 1.
- The minimum number of points in the technical challenge will be zero.

Challenge 5 - Cooperative playing with three robots

The aim of this challenge is to encourage teams to improve their cooperative behaviour as well as their algorithms for planning, and obstacle recognition and avoidance. This challenge is carried out by three active robots and one passive robot, uses the official tournament ball and is disputed in three runs.
PRESET:

- The goal keeper is placed in the middle of the predefined opponent defending goal. It must be disconnected or static (this is the passive robot).
- The first robot (named robot A) is placed in the middle of the penalty area line in the predefined own half of the field.
- The other two active robots (named robot B and robot C respectively) are positioned at the two restart points in front of the penalty area of the predefined opponent side of the field.
- Furthermore, black obstacles (at least one on the own side and two on the opponent side), similar in size to an MSL robot, will be placed on random positions of the field.
- The ball is placed at a random position on the opponent side of the field.

PROCEDURE:

- After receiving a start command from the Referee Box, one of the robots standing in the opponent side of the field (either B or C) has to find and dribble the ball and pass it to robot A.

- Dribbling done by the robot that first touch the ball (either B or C) must occur for no less than 3 meters.
- Neither of the three robots is allowed to cross the middle line.
- When the ball is passed to robot A, it must roll freely for at least 2 meters before it is intercepted by the latter.
- Robot A has to intercept the ball, dribble it around the obstacles for no less than 3 meters and then pass it back to the remaining robot on the opponent side of the field.
- For this pass to be considered valid, the robot that receives the ball must not be the one that found and dribbled the ball in the first place (i.e if robot B dribbled the ball and made the pass to robot A, then it is mandatory that robot A make his pass to the robot C and vice-versa).
- Again, when the ball is passed to the B/C robot, it must roll freely for at least 2 meters before it is intercepted by this robot.
- The third active robot has then to intercept the ball, dribble it around the obstacles for no less than 2 meters, and then shoot it into the predetermined goal where the goalkeeper is standing.
- All robots are allowed to move as soon as the challenge is started. The robot team has 90 seconds to complete each run of the challenge.

SCORING:

- One point is awarded if either robot B or C has correctly identified the ball, (i.e. the robot has touched the ball for the first time and is able to dribble the ball afterwards for at least 3 meters).
- A second point is awarded if this robot correctly executes a pass, (i.e. the ball crosses the mid line and roll freely for at least 2 meters).
- A third point is awarded if the robot A successfully intercepts the pass (i.e. robot A has touched the ball for the first time and is able to dribble it afterwards for no less than 3 meters).
- A fourth point is awarded if the robot A correctly executes a pass, (i.e. the ball crosses the mid line and roll freely for at least two meters).
- A fifth point is awarded if the third robot (B, if C has done the first dribble, or C otherwise) successfully intercepts the pass (i.e. the third robot has touched the ball for the first time and is able to dribble it afterwards for no less than 2 meters).
- A sixth point is awarded if the third robot has successfully scored a goal in the predetermined goal.
- For each of the two passes that have to be performed, two extra bonus points are awarded if the pass is done with a lob shot over one of the obstacles in the field and if the receiving robot is able to control the ball before it goes out of the field.

PENALTIES:

- Every contact of any of the three active robots with an obstacle will be punished with a point, which is subtracted from the amount of points in the current run. A continuous contact with an obstacle (even of it moves the obstacle) will count as a single contact.
- If the ball goes out the field delimiting lines at any time, the attempt is terminated and a point will be subtracted from the amount of points in the current run.
- If the sequence of passes is not done in the correct order, the attempt is terminated with the current amount of points.
- If any of the three robots crosses the middle line, the attempt is terminated with the current amount of points.

The minimum number of points in one run will be zero. In total this challenge is repeated three times with different ball start positions, but always with the same robots, which means that a team can be awarded up to a maximum of eighteen points for this challenge. If teams have the same amount of points, the total time needed for all runs decides on the placement.

Final note: If a team does not have three operational robots at the beginning of the challenge, the challenge can still be be completed with a minimum of two active robots (robots B and C are then replaced by a single robot B). In this case the second pass and the goal will not be considered, which means that the team can score a maximum of four points per run.

Challenge 6 - Ball Control and Planning

Five to eight black obstacles (length/width 40 cm, height 60 cm) are put at arbitrary positions on the field. The ball is put on the middle of the penalty area line, and a robot inside the same goal. The robot should dribble the ball into the opposite goal within 90 seconds, while it avoids all obstacles. One point is awarded to the robot if the ball has passed the center line, another point when a goal is scored. Penalty points are given each time the robot or the ball touches an obstacle. The challenge is repeated three times with various setups. An extra point is awarded to the team with the fastest robot. In order to be eligible for this extra point the robot may not have touched any of the obstacles. In total a team can be awarded up to seven points for this challenge.

Challenge 7 - Cooperative Mixed-Team Play

Teams should demonstrate cooperative mixed-team play between at least two robots from different teams. The selection of the activity to be performed is free, but it should last at most 90 seconds. A jury will evaluate the quality of cooperation and cooperative behaviour and will assign up to six points to each team.

Challenge 8 - Team play with an arbitrary FIFA ball

The aim of this challenge is to encourage teams to improve their vision routines as well as their algorithms for cooperation, arbitrary ball detection and obstacle recognition and avoidance. This challenge is carried out by two robots, three times, with three different standard previously unknown FIFA balls.

The first robot is placed in the middle of the goal area line in the predefined own half. A second robot is placed on a random position in the other half (opponent half) of the field at least 2m away from the middle line.

Furthermore, black obstacles, similar in size to an MSL robot, can be placed on random positions on the whole field.

- At the team leader request, the ball may be placed, for no longer than 10 seconds, in front of the first robot, and at a distance of no less than 50cm from it. After that, the ball is replaced in a random position within the predefined own half of the field.
- The first robot has to find and dribble the ball and pass it to the second robot in the other half.
- Neither of the robots is allowed to cross the middle line.
- When the ball is passed by the first robot it must roll freely for at least 2m before it is intercepted by the second robot.
- The second robot has to intercept the ball, dribble it around the obstacles and shoot it into the predefined goal.
- Both robots are allowed to move as soon as the challenge is started. The robot team has 90 seconds to complete the challenge.
- One point is awarded if the first robot has correctly identified the ball, i.e. the robot has touched the ball for the first time and is able to dribble the ball afterwards.

- A second point is awarded if the first robot correctly executes a pass. The valid pass will only be considered if the ball crosses the mid line of the field without previously going out of the field.
- A third point is awarded if the second robot successfully intercepts the pass (i.e. the second robot has touched the ball for the first time and is able to dribble it afterwards).
- A fourth point is awarded if the second robot has successfully scored a goal in the predefined goal.

Every contact of one of the robots with an obstacle will be restricted with a negative point, which is subtracted from the amount of points in the current run. A continuous contact with an obstacle (even of it moves the obstacle) will count as a single contact. The minimum number of points in one run can be zero. In total this challenge is repeated three times with different balls, but always with the same robots, which means that a team can be awarded up to a maximum of twelve points for this challenge. If teams have the same amount of points, the total time needed for all runs decides on the placement.

Challenge 9 - Play on an outside field

This challenge will only be offered, if it is possible by the organizers to provide a suitable field with respect to the actual field standards. Nevertheless, it is every time possible for teams to prepare by themselves an outside field of their choice which can also be smaller than the regular one. The team should be able to show solutions for typical problems on an outside field. To present these solutions it's not necessary to demonstrate them on a full size field, therefore a minimum field size is set to 10m×8m. If a team prepares a field by their own, even the type of ground can be selected by them, provided that it is the original type of ground of the chosen area, e.g. concrete, artificial turf, etc.
Teams that want to perform in this challenge have to contact the organizing or technical committee as soon as possible, because the resulting scenario needs to be approved by the technical committee.
Each of the above mentioned four abilities can be awarded with 2 points:

- The robots have to present that they are able to handle the ball according to the structure of the ground of the field.
- The robot has to approach a ball over distances of 2, 4, 6 and 8 meters.
- The robot has to avoid 3 obstacles.
- Summary of the above: The robot has to approach the ball over a distance of approx. 4m, then it has to score a goal after crossing a distance of approx. 6m, avoiding 3 randomly placed obstacles on the field and one obstacle in the goal.

A team has six minutes to demonstrate these abilities of their robots.

Appendix

Tables

A 1 Table of Network-Addresses

General Setup:

- WEP encryption is turned off.
- Broadcast of SSID is turned off.
- Subnet mask normal PC: 255.255.255.0.
- Subnet mask of a PC connected to the Refbox: 255.255.0.0.
- Access Point Beacon Interval should be set to 20-30.
- Access Point DTIM Interval should be set to 2-3.

Organization - Network Setup:

	Field A	Field B	Field C
SSID (802.11a)	MSL_FIELD_A_a	MSL FIELD_B_a	MSL_FIELD_C_a
SSID (802.11b)*	MSL_FIELD_A_b	MSL_FIELD_B_b	MSL_FIELD_C_b
SSID (802.11g)**	MSL_FIELD_A_g	MSL_FIELD_B_g	MSL_FIELD_C_g
SSID (802.11n)**	MSL_FIELD_A_n	MSL_FIELD_B_n	MSL_FIELD_C_n
Switch (AP)	172.16.1.1	172.16.2.1	172.16.3.1
Referee Box	172.16.1.2	172.16.2.2	172.16.3.2
Access Point 1 (802.11a)	172.16.1.3	172.16.2.3	172.16.3.3
Access Point 2 (802.11b)	172.16.1.4	172.16.2.4	172.16.3.4
Access Point 2 (802.11g)	172.16.1.5	172.16.2.5	172.16.3.5
Access Point 2 (802.11n)	172.16.1.6	172.16.2.6	172.16.3.6

* Only turned on if at least one team requires it (reported along with the qualification materials).
** It depends on the availability of the LOC to provide Access Points with these technologies.

Team - Network Setup for unicast communication:

Address	Team	Address	Team
172.16.32.*	Organization	172.16.61.*	Smoking Jays
172.16.33.*	5DPO	172.16.62.*	Su-Spada
172.16.34.*	AIS/BIT Robots	172.16.63.*	Tech United Eindhoven
172.16.35.*	AllemaniACs	172.16.64.*	TKU-ITRI
172.16.36.*	Team Aros	172.16.65.*	Ulm Sparrows
172.16.37.*	Attempto Tubingen	172.16.66.*	WinKIT
172.16.38.*	Brainstormers Tribots	172.16.67.*	Water
172.16.39.*	CAMBADA	172.16.68.*	Adro
172.16.40.*	Carpe Noctem Cassel (CNC)	172.16.69.*	Endeavor
172.16.41.*	RFC Stuttgart	172.16.70.*	Hong Kong Dragons
172.16.42.*	EIGEN	172.16.71.*	MU Penguins
172.16.43.*	FU-Fighters	172.16.72.*	Strive-Legends
172.16.44.*	Hibikino-Musashi	172.16.73.*	ROBIT
172.16.45.*	ISePorto	172.16.74.*	ASML Falcons
172.16.46.*	SocRob	172.16.75.*	RV-Infinity
172.16.47.*	Jiao Long	172.16.76.*	ARES
172.16.48.*	Khorasgan University	172.16.77.*	Lushan
172.16.49.*	MINHO	172.16.78.*	CS_Rob
172.16.50.*	Mostly Harmless	172.16.79.*	Robot Club Toulonnais
172.16.51.*	MRL	172.16.80.*	IRIS
172.16.52.*	MRT - Milan Robocup Team	172.16.81.*	Barelang 63
172.16.53.*	NuBot	172.16.82.*	ERSOW
172.16.54.*	Paderkicker	172.16.83.*	
172.16.55.*	Persian Gulf (IAUT)	172.16.84.*	
172.16.56.*	VDL Robot Sports	172.16.85.*	
172.16.57.*	The Orient	172.16.86.*	
172.16.58.*	Osaka University Trackies	172.16.87.*	
172.16.59.*	Robofoot EPM	172.16.88.*	
172.16.60.*	Satrap	172.16.100.* and above	Mixed teams

Team - Network Setup for multicast IPv4 communication:

Address	Team	Address	Team
224.16.32.32	Organization	224.16.32.61	Smoking Jays
224.16.32.33	5DPO	224.16.32.62	Su-Spada
224.16.32.34	AIS/BIT Robots	224.16.32.63	Tech United Eindhoven
224.16.32.35	AllemaniACs	224.16.32.64	TKU-ITRI
224.16.32.36	Team Aros	224.16.32.65	Ulm Sparrows
224.16.32.37	Attempto Tubingen	224.16.32.66	WinKIT
224.16.32.38	Brainstormers Tribots	224.16.32.67	Water
224.16.32.39	CAMBADA	224.16.32.68	Adro
224.16.32.40	Carpe Noctem Cassel (CNC)	224.16.32.69	Endeavor
224.16.32.41	RFC Stuttgart	224.16.32.70	Hong Kong Dragons
224.16.32.42	EIGEN	224.16.32.71	MU Penguins
224.16.32.43	FU-Fighters	224.16.32.72	Strive-Legends
224.16.32.44	Hibikino-Musashi	224.16.32.73	ROBIT
224.16.32.45	ISePorto	224.16.32.74	ASML Falcons
224.16.32.46	SocRob	224.16.32.75	RV-Infinity
224.16.32.47	Jiao Long	224.16.32.76	ARES
224.16.32.48	Khorasgan University	224.16.32.77	Lushan
224.16.32.49	MINHO	224.16.32.78	CS_Rob
224.16.32.50	Mostly Harmless	224.16.32.79	Robot Club Toulonnais
224.16.32.51	MRL	224.16.32.80	IRIS
224.16.32.52	MRT - Milan Robocup Team	224.16.32.81	Barelang 63
224.16.32.53	NuBot	224.16.32.82	ERSOW
224.16.32.54	Paderkicker	224.16.32.83	
224.16.32.55	Persian Gulf (IAUT)	224.16.32.84	
224.16.32.56	Robot Sports	224.16.32.85	
224.16.32.57	The Orient	224.16.32.86	
224.16.32.58	Osaka University Trackies	224.16.32.87	
224.16.32.59	Robofoot EPM	224.16.32.88	
224.16.32.60	Satrap	224.16.32.100 and above	Mixed teams