



IEEE 7th LATIN AMERICAN IEEE STUDENT ROBOTICS COMPETITION

Joint with JRI'2008 (Brazilian Intelligent Robotic Journey) and SBIA'2008 (19th Brazilian Symposium on Artificial Intelligence)

Rules for the IEEE Very Small Competition

Version 1.0

These rules are based on the Mirosoft FIRA® robot soccer category and they are specific for the IEEE Latin America Students Robotics Competition Very Small Size category.

Law 1 : The Field and the Ball

(a) Playground dimensions

A black (non-reflective) wooden rectangular playground 150cm X 130cm in size with 5cm high and 2.5cm thick white side-walls will be used. The topsides of the side-walls shall be black in color with the walls painted in white (side view). Solid 7cm X 7cm isosceles triangles shall be fixed at the four corners of the playground to avoid the ball getting cornered. The surface texture of the board will be that of a ping pong table.

(b) Markings on the playground (Appendix 1)

- The field of play shall be marked as shown in Appendix 1. The center circle will have a radius of 20cm.
- The arc, which is part of the goal area, will be 20cm along the goal line and 5cm perpendicular to it.
- The major lines/arcs (centerline, goal area borderlines and the center circle) will be white in color and 3mm in thick. The free ball (Law 13) robot positions (circles) shall be marked in gray color.

(c) The goal

The goal shall be 40cm wide. Posts and nets shall not be provided at the goal.

(d) The goal line and goal area

- The goal line is the line just in front of the goal which is 40cm long.
- The goal areas shall comprise of areas contained by the rectangle (sized 70cm X 15cm in front of the goal) and the attached arc (20cm in parallel to the goal line and 5cm

perpendicular to it).

(e) The ball

An orange golf ball shall be used as the ball, with 42.7mm diameter and 46g weight.

(f) The field location

The field shall be indoors.

(g) The lighting condition

The lighting condition in the competition site shall be fixed around 1,000 Lux.

Law 2 : The Players

(a) The overall system (Appendix 2)

A match shall be played by two teams, each consisting of three robots. One of the robots can be the goalkeeper (Law 2.b.2). Three human team members, a "manager", a "coach" and a "trainer" shall only be allowed on stage. One host computer per team, mainly dedicated to vision processing and for location identifying, can be used.

(b) The robots

The size of each robot shall be limited to 7.5cm X 7.5cm X 7.5cm. The height of the RF communication antenna will not be considered in deciding a robot's size.

The topside of a robot must not be colored in orange, white or gray nor must not be colored with more than two colors different from black. A color patch either blue or yellow, as assigned by the organizers, will identify the robots in a team. All the robots must have, visible on their top, a solid region of their team color patch, blue or yellow. This region can be of any shape, but must be able to contain (at least) a square with 3.5 cm of side or a circle with 4 cm of diameter. A team's identification color will change from game to game, and the team color patch used should be detachable. When assigned with one of the 2-team colors (blue or yellow), the robots must not have any visible patches of those colors used by an opponent team.

Note : The teams are recommended to prepare a minimum of 2 blue patches and 2 yellow patches for competition. The teams are also recommended to prepare a minimum of 6 different color patches, other than blue and yellow, for individual robot identification.

The robots should wear uniforms and the size of which shall be limited to 8cm X 8cm X 8cm.

A robot within its own goal area (Law 1.d.) shall be considered as the "goalkeeper". The robot assuming the role of goalkeeper can be dynamically changed during the match, as the robot inside its own area (if any) will always be considered as the goalkeeper. The goalkeeper robot

shall be allowed to catch or hold the ball only when it is inside its own goal area.

Each robot must be fully independent, with powering and motoring mechanisms self-contained. Only wireless communication shall be allowed for all kinds of interactions between the host computer and a robot.

The robots are allowed to equip with arms, legs, etc., but they must comply with the size restrictions (Law 2.b.1) even after the appendages fully expanded. None of the robots, except the single designated goalkeeper, shall be allowed to catch or hold the ball such that more than 30% of the ball is out of view either from the top or from the sides (Appendix 3).

While a match is in progress, at any time the referee whistles the human operator should stop all robots using the communication between the robots and the host computer.

(c) Substitutions

Two substitutes shall be permitted while a game is in progress. At half time, unlimited substitutions can be made. When a substitution is desired while the game is in progress, the concerned team manager should call 'time-out' to notify the referee, and the referee will stop the game at an appropriate moment. The game will restart, with all the robots and the ball placed at the same positions as they were occupying at the time of interrupting the game.

(d) Time-out

The human operator can call for 'time-out' to notify the referee. Each team will be entitled for two time-outs in a game and each shall be of 2 minutes duration.

Law 3 : Transmissible Information

The manager, the coach or the trainer may transmit certain commands directly from the remote host computer to their robots only when authorized by the referee or when the game is not in progress. It is not allowed to transmit commands such as reset signals to stop any/all of the robots or restart signals, without the permission from the referee. Any other information, such as game strategy, can be communicated to robots only when a game is not in progress. The human operator should not directly control the motion of their robots either with a joystick or by keyboard commands under any circumstances. While a game is in progress the host computer can send any information autonomously.

Law 4 : The Vision System (Appendix 3)

In order to identify the robots and the ball on the playground, a vision system can be used. The location of a team's camera or sensor system should be restricted to, over and above their own half of the field including the center line, so that the camera need not have to be moved after the side change at halftime. If both teams wish to keep their cameras over and above the center circle

of the playground, they shall be placed side by side, equidistant from the centerline and as close to each other as possible. The location of the overhead camera or sensor system should be at a height of 2m or higher.

Law 5 : Game Duration

The duration of a game shall be two equal periods of 5 minutes each, with a half time interval for 10 minutes.

An official timekeeper will pause the clock during substitutions, while transporting an injured robot from the field, during time-out and during such situations that deem to be right as per the discretion of the timekeeper.

If a team is not ready to resume the game after the half time, additional 5 minutes shall be allowed. Even after the allowed additional time if such a team is not ready to continue the game, that team will be disqualified from the game.

Law 6 : Game Commencement

Before the commencement of a game, either the team color (blue/yellow) or the ball shall be decided by the toss of a coin. The team that wins the toss shall be allowed to choose either their robot's identification color (blue/yellow) or the ball. The team who receives the ball shall be allowed to opt for their carrier frequency band as well.

At the commencement of the game, the attacking team will be allowed to position their robots freely in their own area and within the center circle. Then the defending team can place their robots freely in their own area except within the center circle.

At the beginning of the first and second halves and after a goal has been scored, the ball should be kept within the center circle. With a signal from the referee, the game shall be started and all robots may move freely.

At the beginning of the game or after a goal has been scored, the game shall be commenced/continued, with the positions of the robots as described in Law 6.2.

After the half time, the teams have to change their sides.

Law 7 : Method of Scoring

(a) The Winner

A goal shall be scored when the whole of the ball passes over the goal line. The winner of a game shall be decided on the basis of the number of goals scored.

(b) The Tiebreaker

In the event of a tie after the second half and if the rules of the competition do not allow a tie to happen in this specific match, the winner will be decided by the sudden death scheme. The game will be continued after a 5 minutes break, for a maximum period of three minutes. The team managing to score the first goal will be declared as the winner. If the tie persists even after the extra 3 minutes game, the winner shall be decided through penalty-kicks. Each team shall take three penalty-kicks, which differs from Law 11 as only a kicker and a goalkeeper shall be allowed on the playground. The goalkeeper should be kept within its goal area and the positions of the kicker and of the ball shall be the same as per the Law 11. After the referee's whistle, the goalkeeper may come out of the goal area. In case of a tie even after the three-time penaltykicks, additional penalty-kicks shall be allowed one-by-one, until the winner can be decided. All penalty-kicks shall be taken by a single robot and shall commence with the referee's whistle. A penalty-kick will be completed, when any one of the following happens:

- The goalkeeper catches the ball with its appendages (if any) in the goal area.
- The ball comes out of goal area.
- Thirty (30) seconds pass after the referee's whistle.

Law 8 : Fouls

A foul will be called for in the following cases:

Colliding with a robot of the opposite team: the referee will call such fouls that directly affect the play of the game or that appear to have potential to harm the opponent robot. When a defender robot pushes an opponent robot without the ball, a free kick will be given to the opposite team if the referee considers that the foul is relevant to the match. It is permitted to push the ball and an opponent player backwards provided the pushing player is always in contact with the ball.

It is permitted to push the goalkeeper robot in the goal area, if the ball is between the pushing robot and the goalkeeper. However, pushing the goalkeeper into the goal along with the ball is not allowed. If an attacking robot pushes the goalkeeper along with the ball into the goal or when the opponent robot pushes the goalkeeper directly then the referee shall call goal kick as goalkeeper charging.

Attacking with more than one robot in the goal area of the opposite team shall be penalized by a goal kick to be taken by the team of the goalkeeper. A robot is considered to be in the goal area if it is more than 50% inside, as judged by the referee.

Defending with more than one robot in the goal area when the ball is inside the goal area shall be penalized by a penalty-kick, except if a goal is scored by the attacking team. A robot is considered to be in the goal area if it is more than 50% inside, as judged by the referee. If the ball enters inside the goal area where there are two defending robots or if a second defending robot enters inside the goal area where there are already the goalkeeper and the ball, the referee must

penalize the defending team with a penalty kick to the opposite team. If the ball is not in the goal area, there are no penalizations for teams with two defending robots inside its own goal area.

It is referred to as handling, as judged by the referee, when a robot other than the goalkeeper catches the ball. The ball is considered caught when a robot firmly attaches itself to the ball in such a way that no other robot can move the ball. The team will be penalized with a free kick if the infraction happens outside its own goal area or with a penalty kick if it happens inside its own goal area.

When the goalkeeper controls the ball without dispute, it must kick out the ball from its goal area (Law 1.d.) within 10 seconds. The failure to do so will be penalized by giving a penalty kick to the opposite team. If an attacking robot disputes the ball with the goalkeeper during this time, the time count is restarted. Giving a goal kick to the team of the goalkeeper will penalize the blocking of a goalkeeper in its goal area. Only the referee and one of the human members of a team (manager, coach or trainer) shall be allowed to touch the robots. The award of a penalty-kick shall penalize touching the robots without the referee's permission.

Law 9 : Play Interruptions

The play shall be interrupted and relocation of robots shall be done only when:

- A robot has to be changed.
- A robot has fallen in such a way as to block the goal.
- A goal is scored or a foul occurs.
- Referee calls free kick (Law 10), penalty kick (Law 11), goal kick (Law 12) or free-ball (Law 13).

The robots can be relocated by a human operator or by their own means. When the referee calls free-ball, the relocation by humans is not allowed, as presented in Law 13.

Law 10 : Free Kick (Appendix 4)

When a defender robot pushes an opponent robot, a free kick will be given to the opposite team (Law 8.1.).

The ball will be placed at the relevant free kick position (FK) on the playground (Appendix 1). The robot taking the kick shall be placed behind the ball. The attacking team can position its robots freely within its own side. The defending robots shall be placed in touch with the goal area on either side of the arc. With the referee's whistle all robots can start moving freely.

Law 11 : Penalty-Kick (Appendix 5)

A penalty-kick will be called under the following situations.

- Defending with more than one robot in a goal area (Law 8.4.).
- Failure on the part of a goalkeeper to kick out the ball from its goal area within 10 seconds (Law 8.6.).
- When any one of the human members touches the robots without the referee's permission, while the game is in progress (Law 8.8.).

When the referee calls a penalty-kick, the ball will be placed at the relevant penalty kick position (PK) on the playground (Appendix 1). The robot taking the kick shall be placed behind the ball. While facing a penalty kick one of the sides of the goalkeeper must be in touch with the goal line. The goalkeeper may be oriented in any direction. Other robots shall be placed freely within the other side of the half-line, but the attacking team will get preference in positioning their robots. The game shall restart normally (all robots shall start moving freely) after the referee's whistle. The robot taking the penalty-kick may kick or dribble the ball.

Law 12 : Goal Kick (Appendix 6)

A goal kick will be called under the following situations:

- When an attacking robot pushes the goalkeeper in its goal area, the referee shall call goal kick as goalkeeper charging (Law 8.2.).
- Attacking with more than one robot in the goal area of the opposite team shall be penalized by a goal kick to be taken by the opposite team (Law 8.3.).
- When an opponent robot blocks the goalkeeper in its goal area (Law 8.7.).
- When the goalkeeper catches the ball with its appendages (if any) in its own goal area.
- When a stalemate occurs in the goal area for 10 seconds.

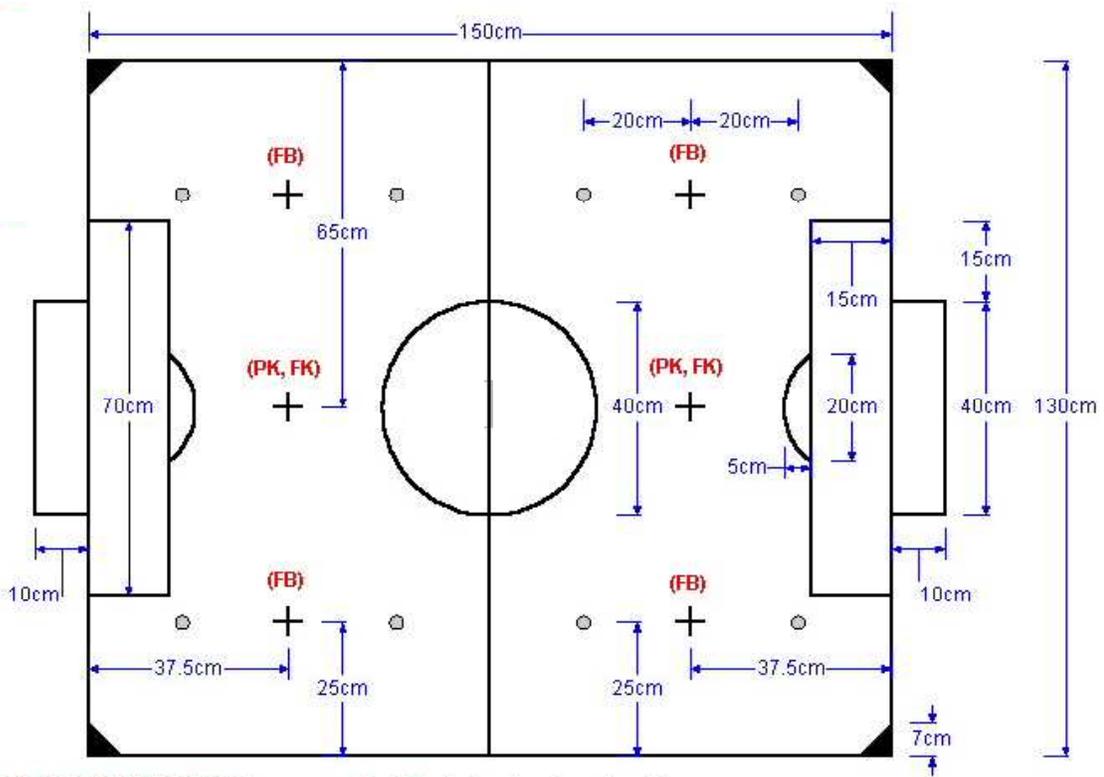
During goal kick only the goalkeeper will be allowed within the goal area and the ball can be placed anywhere within the goal area. Other robots of the team shall be placed outside the goal area during goal kick. The attacking team will get preference in positioning their robots anywhere on the playground, but it must be as per Law 8.3. The defending team can then place its robots within their own side of the playground. The game shall restart with the referee's whistle.

Law 13 : Free-Ball (Appendix 7)

The referee will call a free-ball when a stalemate occurs for 10 seconds outside the goal areas. In this case, the robots can only be relocated by their own means or by the referee, and not by a human member of the team.

When a free-ball is called within any quarter of the playground, the robots must stop and the ball will be placed by the referee at the relevant free ball position (FB) (Appendix 1). The referee must also manually relocate all the robots which are less than 20cm of distance from the relevant free ball mark, longitudinally moving the robots toward their own field until they are aligned with the relevant free ball robot positions (gray circles), located 20cm apart from the ball position in the longitudinal direction of the playground. After that, one (or none) robot per team can automatically place itself at the relevant free ball robot position (gray circle) nearest its own goal. The other robots (of both teams) must stay where they are. The game shall resume when the referee gives the signal and all robots may then move freely.

[Appendix 1] ARENA DIMENSIONS



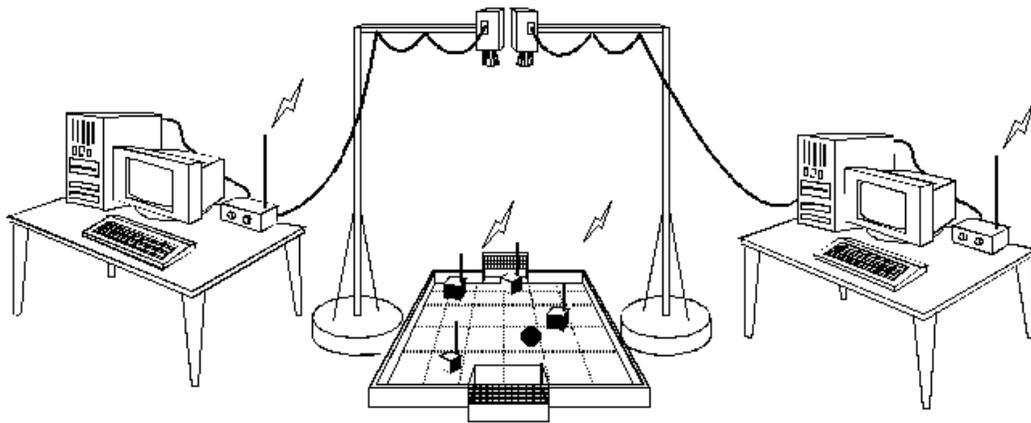
FB - Free-Ball ball positions
FK - Free-Kick ball positions
PK - Penalty-Kick ball positions
All solid lines are 3mm thick

○ Free-Ball robot positions (gray in color)
 Side walls - 2.5(cm) thick, top view black in color, side view white in color

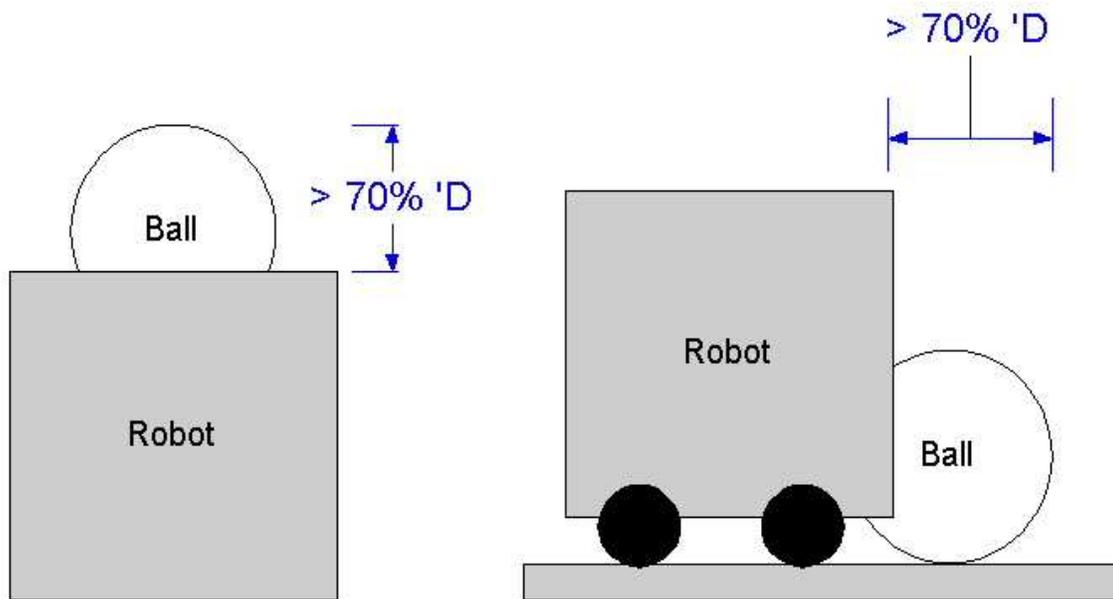
[Appendix 2]

Appendix 2

Overall system

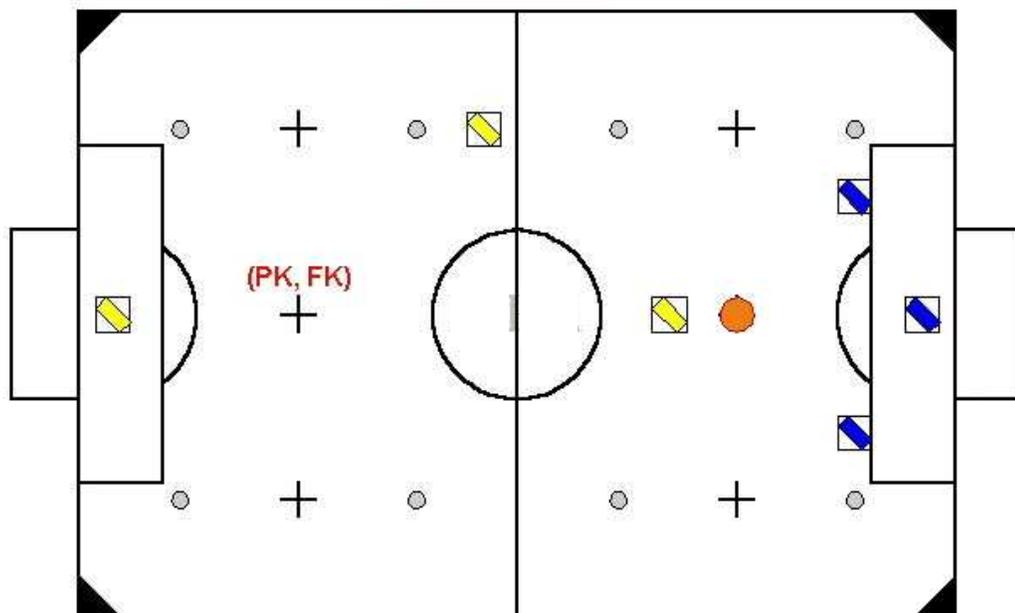


[Appendix 3]



[Appendix 4]

Free-Kick



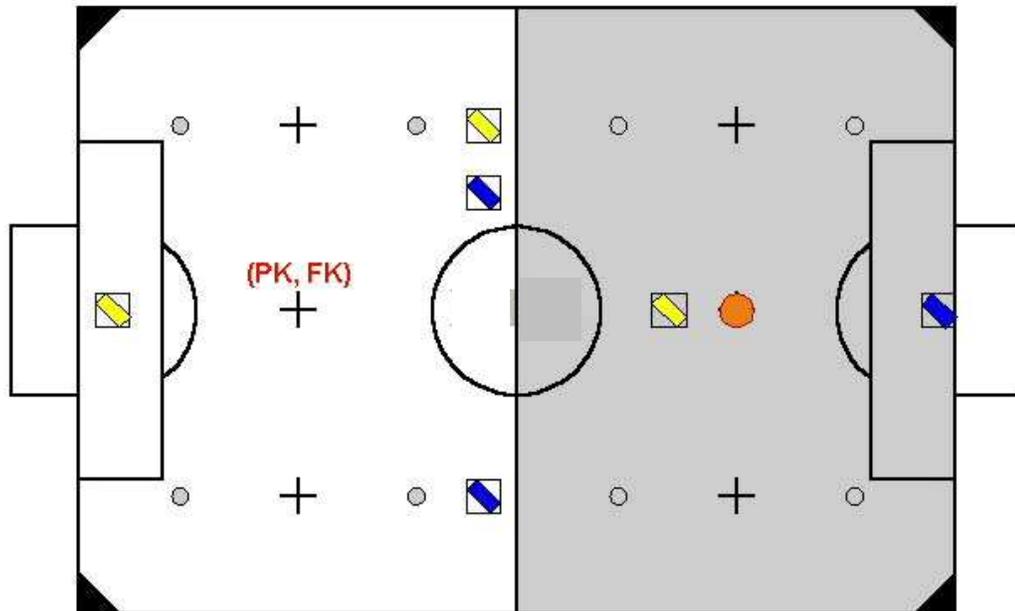
Free-Kick situation:

1. defender robot intentionally pushes an opponent robot

Robots and ball positions:

1. robot taking the ball behind the ball
2. defending robots in touch with the goal area on either side of the arc
3. the defending team should position their robots first

Penalty-Kick



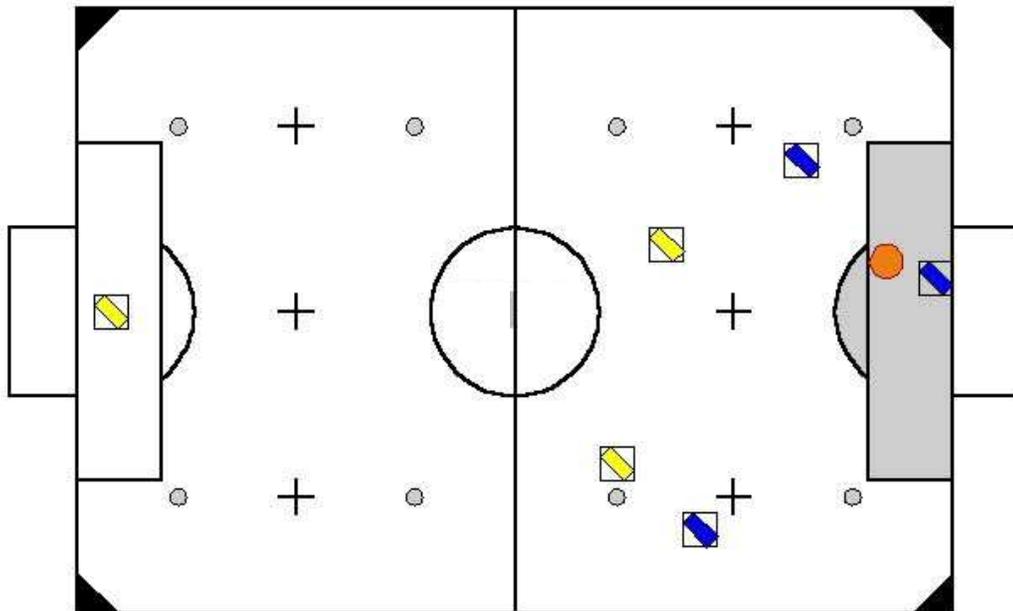
Penalty-Kick situation:

1. defending with more than one robot in the goal area
2. goalkeeper fails to kick out the ball from goal area within 10 seconds
3. human operators touch the robots without the referee's permission

Robots and ball positions:

1. robot taking the kick behind the ball
2. defending goalkeeper should be in touch with the goal line
3. all other robots of both the teams on the other half of the playground
4. the defending team should position their robots first

Goal-Kick



Goal-Kick situations:

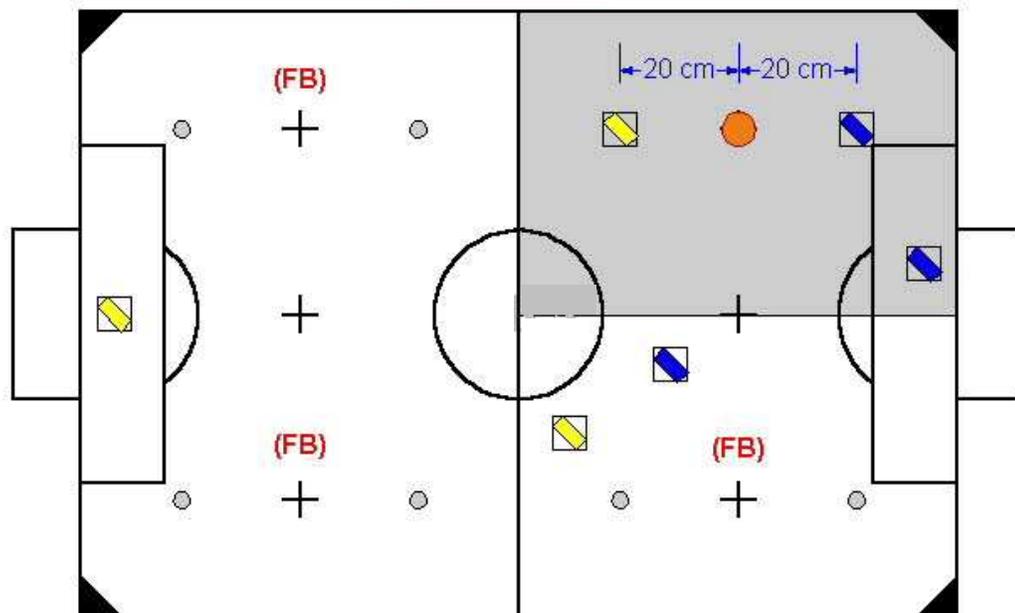
1. an attacking robot pushes the goalkeeper in its goal area
2. attacking with more than two robots in opposite goal area
3. opponent robot intentionally blocks the goal keeper
4. goal keeper catches the ball in its goal area with its appendages (if any)
5. stalemate in goal area for 10 seconds

Robots and ball positions:

1. only the goal keeper allowed in the goal area
2. ball can be placed anywhere inside the goal area
3. the defending team should position their robots first

[Appendix 7]

Free-Ball



Free-Ball situation:

1. stalemate outside goal area for 10 seconds

Robots and ball positions:

1. one robot per team, 20 cm apart on either side of the ball (horizontal direction)
2. other robots of both teams outside the quarter where Free-Ball is being called
3. the defending team should position their robots first