AndroSot Challenge

Laws of the Game 2024, FIRA RoboWorld Cup

Chair

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Abstract

The official version of the rules of the game for AndroSot Challenge is based on the concepts from the HuroCup games. The primary idea came from Professor Tzuu-Hseng Steve Li in 2011. Some comments from Professor Kuo-Yang Tu, the FIRA 2011 General Co-Chair, have also been applied to the rules for AndroSot Challenge. The Challenge games aim to promote the abilities of attack and defense in androids and also consist of several tasks such as dribbling, obstacle avoidance, shooting, trajectory detection, goalkeeping, role arrangement, and positioning control. Prof. Ming-Yuan Shieh contributed a lot in modifying the Challenge rules for FIRA 2017. Two challenge events in FIRA 2019 are the same as those in 2018, the 1st challenge event is Dribble and Attack, and the 2nd challenge event is Free Kick.

Every team should attend the AndroSot Challenges, only some qualified teams can participate the AndroSot match. The number of qualified teams will be discussed and determined in the team leader meeting of AndroSot at the first day of 2024 FIRA RoboWorld Cup.

Changes added into text of rules for 2024 are colored into red.

1. Setting up the Game

1.1 The Field (Appendix A)

The challenge events are executed on the same field of AndroSot game. Please refer to the AndroSot game laws for a description of the field. In addition, areas and labels need to be noticed in Appendixes A-1 and A-2.

1.2 Vision and Lighting

All definitions are the same as those of AndroSot game. Please refer to the AndroSot game laws for a description of the field. All active distance sensors are disallowed to set up on the Android to measure the relative distances among Androids.

2 The Overall System and Robots

2.1 The Overall system (Appendix B)

2.1.1 A challenge is played by a team once, each consisting of two robots/one robot in the first/second challenge event respectively.

2.1.2 Each team may prepare one more Android for substitution.

2.1.3 All robots are controlled by off-board computers. (Exception: The goalkeeper used in the 2nd challenge can be fully autonomous).

2.1.4 At most two designated team members are allowed to access the playground during a game (if instructed so by the referee), except during timeouts and halftime.

2.1.5 Each team should make sure that all necessary equipment is close enough to the court.

2.2 The Robots

2.2.1 Every robot has to meet the standard of AndroSot game.

2.2.2 Obstacle Robots:

(a) There are 2 obstacle robots placed on the dotted line area (Appendix A-1), in which each robot is placed in different area respectively, during the 1st challenge event. In addition, there is one goalkeeper placed on one of three given positions in the goal area (Appendix A-2) during the 2nd challenge event.

(b) The locations of the robots are decided and fixed by the referees for each task. Every team will get the same assignment.

(c) After each task, the referees will reassign the positions of the obstacle robots for the next task.

2.2.3 Playing Android:

(a) The team can only assign the same androids whenever doing every task. However, it is permitted to replace the bench android once for next tasks during a challenge. (as *Challenge Rule 2.1.2*)

(b) The android needs to be controlled by off-board computers and start from the preset position for every task.

2.3 Color marks of players

2.3.1 All androids must be equipped with player marker.

2.3.2 Player marker must be in shape of cube with dimension 8cm ~ 9.5 cm. Cube must be fixed on top of android over its shoulders. 5 sides of cube must contain binary ArUco codes for recognition by machine vision.

2.3.3 Goalkeeper player which carries onboard camera can be equipped with cube covered by ArUco codes from 4 sides in order to keep one side free for camera.

2.3.4 Conventional ArUco marker contains 2 colors: Black and White. ArUco markers used for Androsot must be one from two combinations: Blue and White or Red and White depending on team color Blue or Red. In case if team color is Blue all codes of ArUco marker must be even, i.e. one code from sequence: 0,2,4,6,8,10,12 … In case if team color is Red then all codes of ArUco marker must be odd, i.e. one from sequence 1,3,5,7,9,11,13…

2.3.5 The team color is always blue in AndroSot Challenge games. The color red will be assigned to the obstacle robots during the 1st challenge event.

3 The Game

3.1 Game Duration

3.1.1 Each challenge will have 6 tasks in the 1st and the 2nd challenge events respectively. The total duration of each challenge (at most 6 tasks) for a team is 10 minutes.

3.1.2 During the same task or section for every team's challenge, all the androids and the systems are disallowed from tuning, modifying, setting up, debugging or changing components.

3.2 Game Commencement and Progress

3.2.1 20 minutes before each challenge event every team will get the same assignment.

3.2.2 At the start of the game, each team must have proper working robots on the playground as defined in *Challenge Rule 2.1.2*.

3.2.3 During every challenge event, only one bench android is allowed to be substituted for a team. If the team has no proper android to perform challenges, the undone tasks will score zero.

3.2.4 At the beginning of each challenge, the referee shall blow a whistle. The robots are disallowed to move before the whistle. If the task is done incorrectly, the task is regarded as failed.

3.2.5 When a task has been started and performed, if done without any referee's permission, all operators of the team members are prohibited from touching the mouse or sending any control command into the control systems; besides, sending or causing disturbance

signals for the opposing side is also prohibited. If any team has committed such a violation for the first time, the task will be stopped and the score will be zero; for the second time or more, the team will be dropped from the challenge.

3.3 The 1ˢᵗ challenge event – Dribble and Attack task

In the 1ˢᵗ challenge event, each team must assign two androids to challenge the tasks.

3.3.1 There are 3 starting points on the field as shown in Appendix A-1. The team can start their tasks **twice** at every point. The total duration of all tasks (the most 6 tasks) is 10 minutes for each team.

3.3.2 For each task, the 1ˢᵗ android is placed 15 cm away from the preset ball and facing the goal; the 2ⁿᵈ android is placed at one of the other two ball positions by a draw before the task. However, after the draw, the referee will not at first announce the result. At first, the challenge team needs to run the programs in which it shall add enough idle time (10 seconds or more) in the beginning section, then the referee will announce the result of the draw to prompt the team to place the 2ⁿᵈ android at the set position. Ongoing, the androids will go and kick by off-board computers without other inputs, and the 1ˢᵗ android has to kick the ball after its movement within 20 seconds.

3.3.3 The team can repair or test the android or the system but the time still is counted continuously.

3.3.4 The team members can decide the order of the 6 tasks by themselves.

3.3.5 There is one of the following cases occurred, the task is finished.

(a) the ball enters the goal area,

(b) the duration of the challenge is over,

(c) the android touches any obstacle robot,

(d) the ball has passed all the obstacle robots but the 2ⁿᵈ android still hasn't touched the ball,

(e) there is no proper android to enter the challenge,

(f) any prohibited behavior occurs.

3.3.6 The 1ˢᵗ android has to kick or dribble the ball away at least 10 cm from the starting point firstly, and then only the 2ⁿᵈ android is allowed following to dribble, pass, kick and shoot the ball into the goal.

3.3.7 The 2ⁿᵈ android can kick, dribble, shoot or do any action if it does not meet *Challenge Rule 3.3.5*.

3.3.8 If the team does not prohibit *Challenge Rule 3.3.6* or *Challenge Rule 3.3.5(c),(d)*, while the ball passes the obstacle robots and/or enters the goal area, the team scores a goal. The referee or assistant records the accomplished time which will be rounded off to the nearest tenth in second.

3.3.9 Scoring:

(a) After the 1ˢᵗ android kicks and dribbles the ball away at least 10 cm from the starting point and the 2ⁿᵈ android then touches the ball, the team will score **10 points**.

(b) After the success of (a), while the ball is kicked by the 2ⁿᵈ Android (only) and passes any obstacle robot, it scores **additional 10 points** for each pass. (**20 points** total at most) It can be noted that the passes are only counted from the location while the 2ⁿᵈ android has caught the ball.

(c) After the successes of (a) and (b), while the ball enters the goal area successfully, it scores **additional 20 points**.

(d) The accomplished time is recorded but no additional point; it is just for counting the total duration.

3.4 The 2ⁿᵈ challenge event – Free Kick task

3.4.1 In the 2ⁿᵈ challenge, each team only can assign one android to do the task.

3.4.2 There is only one starting area, which is inside the center circle. There are 3 free kick points on the field on which to place the ball, as shown in Appendix A-2.

3.4.3 There is an obstacle robot placed at one of the left, the center, or the right sections in front of the goal.

3.4.3 The android have 2 tasks to shoot the ball from the draw starting point facing the obstacle robot placed at the same section. This means the obstacle robot is fixed and decides on the relevant position of the ball of each task respectively by drawing. A draw will result in two selected positions of the ball from 9 possible combinations such as 11, 12, 13, 21, 22, 23, 31, 32, and 33. If the combination 13 is selected, it means the team will free kick the ball at the 1ˢᵗ position first and then free kick the ball at the 3ʳᵈ position. However, the result of the draw must be kept on the referee and announced according to *Challenge Rule 3.4.4*.

3.4.4 Before the start, the team places their android within the center circle and draws the position of the ball (not yet announced) first, then run the program (the first 10 seconds or enough duration of the program should be designed as idle). Next, the referee announce the result of the draw to prompt the team to place the ball at the set position, then finally the android go and kick by off-board computers without other inputs. The android has to kick the ball after its movement within 60 seconds. However, in each task, the android is only allowed to kick the ball once.

3.4.5 For each task, the off-board program has to wait the ball decision enough time (10 seconds or more). Each team can perform 6 tasks mostly and its total duration is 10 minutes. With the permission of the referee, the team can repair or test the android or the system, but the time still is counted continuously.

3.4.6 The team members can decide the order of the three obstacles challenges by themselves.

3.4.7 If one of the following cases occurs, a task is finished.

(a) the ball stops on the field,

(b) the ball enters the goal area,

(c) the ball touches the side walls,

(d) the duration of all the tasks is over,

(e) the android kicks the ball twice or more times,

(f) there is no proper android that could enter the challenge,

(g) any prohibited behavior occurs.

3.4.8 Scoring:

The score of each successful free kick (kick away the ball) is **10 points**. If the ball be kicked in the penalty area which including the penalty line, it is marked as a PA kick and scores **additional 20 points**. Moreover, if the free kick is a goal, it scores **additional 20 points**. This means the total scores of a task are **50 points** mainly.

For example as tabulated in the *Table 3.4.1*.

Table 3.4.1. The total scores of different cases after 2 tasks facing the left position obstacle Case 1 (the ball pos. are 1,3 by drawing)

Position L (obstacle robot)	Touch ball	PA kick	Goal	Score
(ball pos. 1) 1st Task	O (10)	O(20)	X	30
(ball pos. 3) 2nd Task	O (10)	O(20)	O(20)	50
Total Score of Pos. L				80

Case 2 (the ball pos. are 2,2 by drawing)

Position L (obstacle robot)	Touch ball	PA kick	Goal	Score
(ball pos. 2) 1st Task	O (10)	X	X	10
(ball pos. 2) 2nd Task	X	X	X	0
Total Score of Pos. R				10

3.5 Winning

3.5.1 The Winner:

In each challenge event, there are different objectives for scoring. However, the winner of each challenge event shall be decided by the total score.

3.5.2 In a tie:

If there are two or more teams in a tie by compared with the total score will be resolved as follows:

(a) In the 1st challenge: The team that accomplishes all the tasks in the shortest time totally will be the winner.

(b) In the 2nd challenge: The total number of goals is compared which the higher is the winner. If also, the total number of the PA kicks is higher and regarded as the winner.

(c) If also, those same score teams get the same rank.

3.6 Interruptions

The game is interrupted whenever the referee blows a whistle. The human operator must then stop the communication between the robots and the host computer.

3.6.1 When a robot falls down and is unable to stand up on its own for more than 20 seconds, or the robots take no action for more than 20 seconds, the referee instructs a team handler to remove the robot(s) and repair it if necessary. A repaired or substituted robot

can start the following undone challenges.

3.6.2 The duration of each task consists of the total time of repair and substitution and is limited to the lawful game duration in *Challenge* *Rule 3.1*.

3.6.3 Each team just could only substitute the robot once during every challenge event.

3.6.4 If the robot restarts from the beginning area because of a team's request, the score in this task will be reset to zero at the moment. However, in the 2nd challenge event, it is not allowed to restart a done task.

3.6.5 Teams can only enter the court under the permission of the judge.

3.7 Transmissible Information

The information that is being transmitted has to meet the standard of AndroSot game.

4. Fouls

4.1 The 1st challenge event – Dribble and Attack tasks

4.1.1 The following actions are disallowed.
   (a) A robot collides with any obstacle robot, either intentionally or otherwise: the referee will call such fouls that directly end the game.
   (b) A robot starts before the referee blowing a whistle.
   (c) The team members enter the court or execute disallowed actions such as touching or remote controlling the androids without the permission of the referees.

4.1.2 The following cases are regarded as failures.
   (a) The 1st android goals directly.
   (b) The ball enters the goal area because of the touch by robotic hands.
   (c) To goal occurs after the end of lawful duration.

4.2 The 2nd challenge event – Free Kick tasks
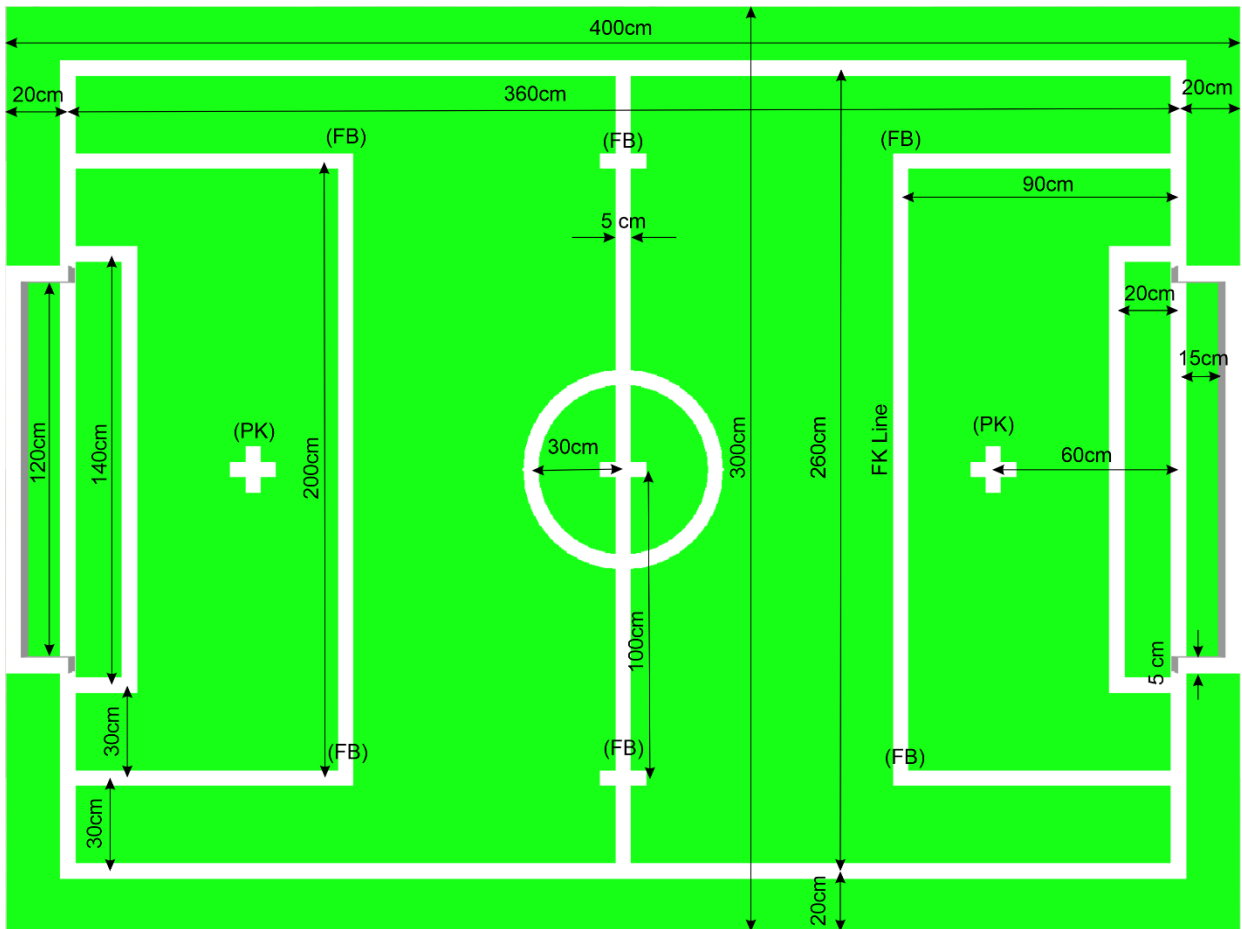
4.2.1 The following actions are disallowed.
   (a) The android kick the ball twice or more times.
   (b) The robot starts from the outside of the center circle.
   (c) The robot starts before the referee blowing a whistle.
   (d) The team members enter the court or execute disallowed actions such as touching or remote controlling the androids without the permission of the referees.

4.2.2 The following cases are regarded as failure.
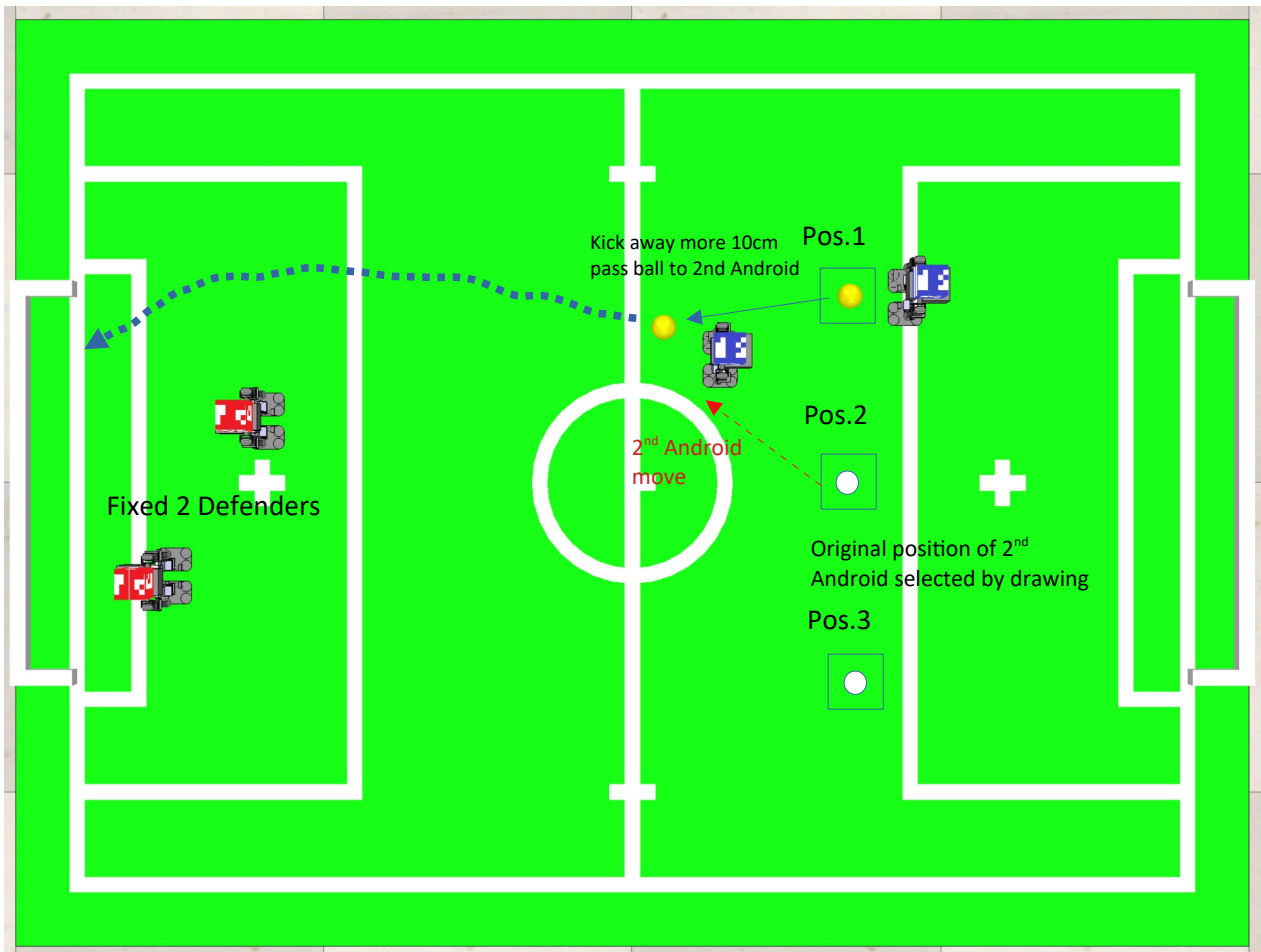   (a) A robot cannot go closer to kick or touch the ball within the limited time in *Challenge Rule 3.3.3*.
   (b) The ball enters the goal area because of the touch by robotic hands or being reflected off the side walls.
   (c) A goal occurs after the end of lawful duration.

Appendix A

The game field for the challenge events of AndroSot Challenge. All lines and marks are white.
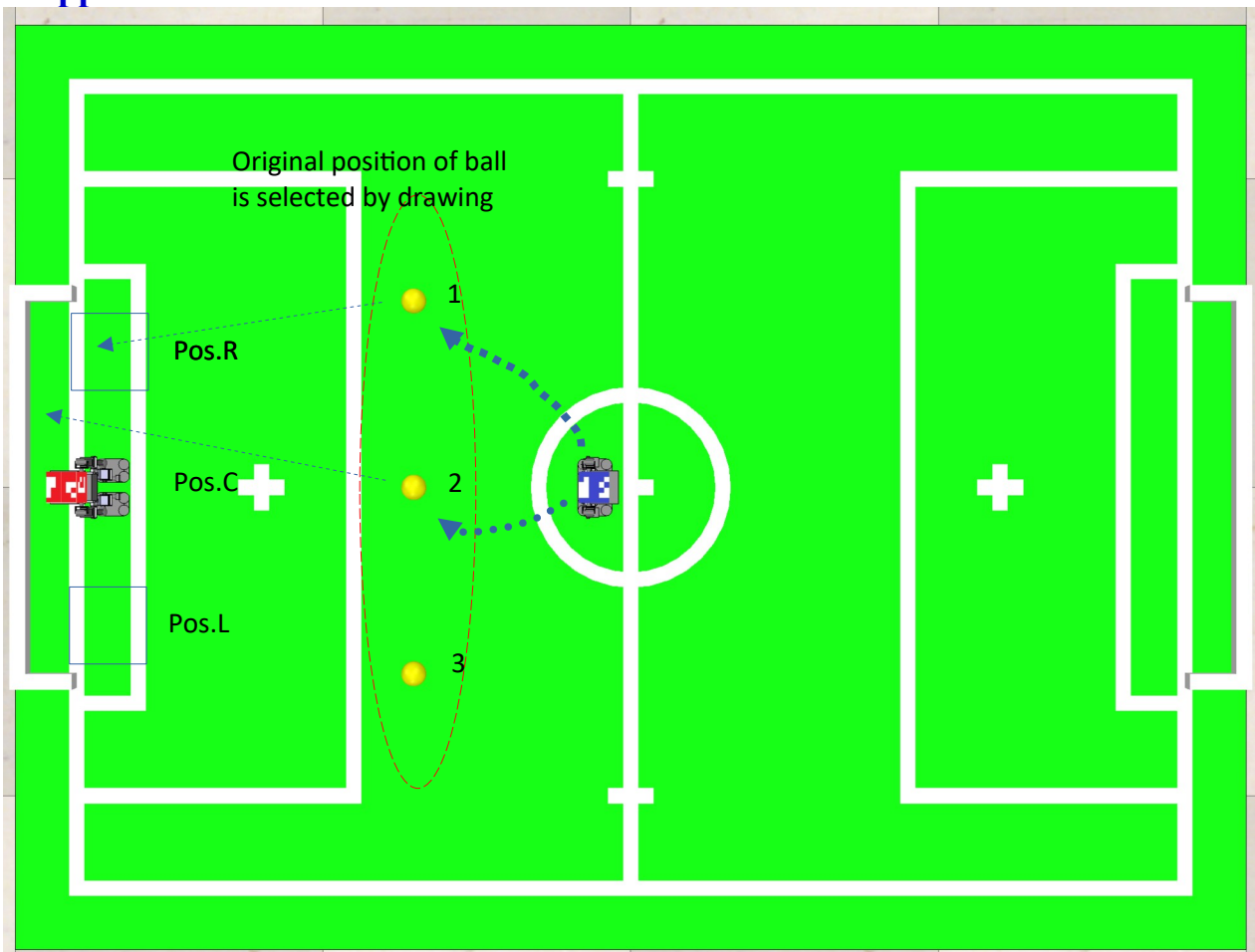
Appendix A-1

Kick away more 10cm pass ball to 2nd Android

Pos.1

2nd Android move

Pos.2

Original position of 2nd Android selected by drawing

Pos.3

Fixed 2 Defenders

A successful case of a dribble and attack task (with successful catching, passing, dribbling and attacking)

Appendix A-2

Original position of ball
is selected by drawing

Pos.R

Pos.C

Pos.L

1

2

3

There is one of the 3 possible positions of the ball selected by a draw to free kick facing each position of the obstacle robot.