

Autonomous robot football

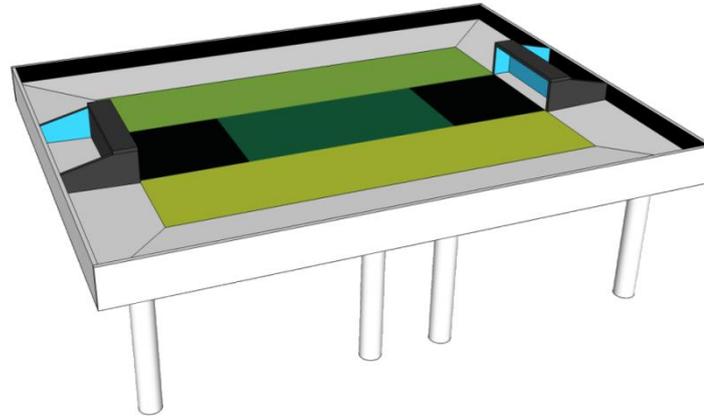


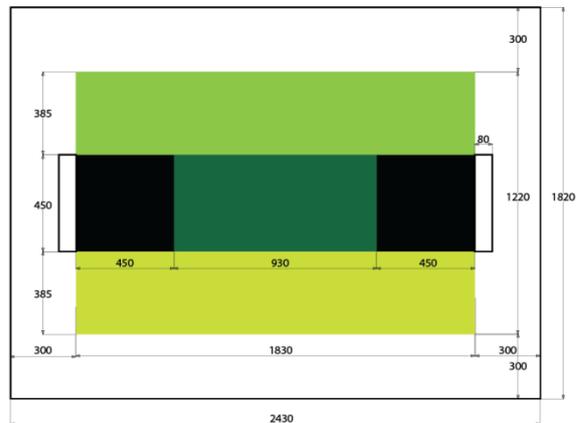
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Remark: The teams are recommended to provide in the robot construction the possibility to overcome small obstacles with height of 5 mm both on the playing field and its borders.

1. Playing field

1. Field
 1. Playing field for competitions has the following dimensions: 1220 x 1830 mm. Along the perimeter of the field it is drawn the border - white line with width of 300 mm.
 2. Field surface has wear resistant vinyl or plastic covering.
 3. The central part of the playing field shall be absolutely flat and horizontal. All white borders including borders on the field's ends, shall be elevated towards to outer sides on 10 mm.
 4. The playing field shall be placed on the cover or felt bedding.
 5. The playing field can be placed both on the table and the floor.
2. Fencing walls.
 1. Around the playing field including behind the goals it is installed the matted black fencing walls.
 2. Walls height is 80 mm. (70 mm *WRO2013*)
 3. Fencing walls can be manufactured of the various materials, as it does not effect on the game.



3. Goals.
 1. Each goals width is 450 mm.
 2. Back and side walls of the goals is painted sky-blue colour inside. The floor inside the goals -white. Outer part of the goals is painted matted black colour.
 3. Depth of each goals is 80 mm. (74 mm *WRO2013*)
 4. Each goals has black horizontal bar, installed at the level of 140 mm above the floor.
 5. The playing field surface shall be absolutely flat and horizontal inside.
4. Neutral zones.
 1. On the playing field it is provided two neutral zones.
 2. The first neutral zone is formed by the border of the dark-green zone and the green zone and the second neutral zone is formed by the border of the dark-green zone and light-green zone (on the field neutral zones are not shown).
5. Illumination and magnetic fields
 1. Teams shall be prepared to calibrate their robots according to the illumination and magnetic fields conditions in the place of competition. Olympic organizers shall use every effort to maintain the minimum allowed illumination level on the football fields and place them as far as possible from the magnetic fields sources, e.g. from the electric wires and metal objects. Though sometimes it is not possible.

Remark: Teams are recommended to provide in the robot construction the possibility to act successfully under alternating illumination and magnetic field conditions, since in different competition places the can be different.

2. Ball.

1. Technical specification.
 1. For the game it will be provided appropriately balanced electronic ball with diameter of 8 mm.
 2. The ball will emit pulse (MODE D (1200 Hz pulsed)) infra-red (IR) radiation.
 3. Balls' supplier?
Official ball supplier for Robot football will be HiTechnic - Infrared Electronic Ball (IRB1005). Details of these balls can be found on the web-site: www.HiTechnic.com.



3. Robots.

1. Robot dimensions.
 1. Robot dimensions shall be defined in the «standing posture» considering all maximum prominent parts.
 2. The robot positioned this way shall be within the cylinder with the inside diameter of 220 mm.
 3. Robot height shall be 220 mm max.?
 4. Weight of each robot shall be 1 kg max.
 5. During the check each robot shall be set to position with the maximum height and prominent part scope. If the robot is equipped with moving parts, that protrude in two directions this robot shall be checked in action. At that the robot shall not touch the walls of the check cylinder.
2. Robot control.
 1. Robots shall be capable to operate autonomously.
 2. It shall be provided the possibility of the manual robot start.
 3. It prohibited to use robot remote control systems.
 4. Robots shall be capable to move in all directions.
 5. It is possible to use bluetooth connection to connect the robots with each other?, but if it does not effect on the other robots functionality.

Remark: Robots shall have the possibility to switch of their communication devices at referee request.

- 1 Robots' identifications/colours.
 1. Competitors shall identify their robots in any way so that their belonging to the same team is visible.
 2. Robots shall be coloured and marked so that it does not effect on the game and on the other robots' sensors.
- 2 Teams
 1. In all teams there shall be two (2) robots max. During the competition it is prohibited any robot replacements. Otherwise the team will be disqualified.
- 3 Robot construction.
 1. Robots shall be built of only branded elements, motors and sensors of LEGO.
 2. It is prohibited to use any other materials, including glue, adhesive tape, screws etc. The exception is only using of tie wraps or adhesive tape to fasten the wires.
 3. All used electric elements shall be the elements of LEGO MINDSTORMS type erector. In one match it can be used the limited number of the electric elements:

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For RCX users:	For NXT users:
RCX unit (1)	RCX unit (1)
Motors (3)	Motors (3)
Contact sensors (2)	Contact sensors (2)
Light sensors (2)	Light sensors (2)
Lamps (1)	Lamps (1)
RPM meters (3)	RPM meters (3 minus the number of the existing NXT motors)
Tritium contact OR light sensor (1)	Proximity sensor (1)
RCX compass-sensor (1)	NXT compass-sensor (1)
RCX flyeye R0326 sensor(1)	NXT IR sensor (IR seeker sensor) (1)

6. Ball capture zones and moving areas

1. Ball capture zones are any internal space of the playing field within the area limited by the straight edge, applied to the robot prominent parts.
2. The ball may penetrate into the capture zone for 3 cm max.
3. Robot shall not "hold" the ball.
4. Robot is prohibited to hold ball under itself.
5. The ball shall always be «in the view» so that other players could have access to any part of robot at any moment of the match, robot's parts shall not overlap the ball for more than the radius.
6. The only exclusion of the rule 3.6.3 is using of revolving drum to apply to the ball dynamic reverse rotation to hold it. This impact is called "dribbling".
7. The robot, «dribbling» the ball, shall comply with the rule 3.6.2. The distance between the contact point of this robot and the center of robot shall be 3 cm.

Remark: «Holding the ball» means the full ball control using blocking of all ball's degrees of freedom. For example, if the robot press the ball to its body or cover it with any of its elements, making difficult the access to the ball for other «players». The robot is considered «holding» the ball, if the ball stops rotating, when the robot «dribbles» the ball or if the ball do not bounces when hitting the robot.

7. Goalkeepers

1. If the team uses goalkeeper, it is not enough for goalkeeper to move in only one direction, it shall be programmed so that it is able to move in any direction on the playing field.
2. The goalkeeper shall move towards to try to run with the ball in front of the goals. If necessary the robot shall have the possibility to move outside the scoring-area (for the distance of 45 cm max from the goals).
3. If the robot-goalkeeper does not move along the straight line, it will be considered as «Fault robot» (see Paragraph 4.7).

Remark: The goalkeeper shall not move aside, it is allowed to move only towards.

4. Matchmaking.

1. Pre-settings.

1. Competition organizers allows access to the playing field to set up and check the robots before competition start according to the schedule tha will be published at the competition beginning.
2. Organizers will try to give at least 10 minutes to check the settings before each game.

3. The referee will check the ball functionality before each period (the half of the game) of the match.
4. In the same period the teams can advance a claim against competitors' robots.
2. Game duration.
 1. The match will consist of two 10-minutes periods. According to the competition organizing committee the period duration in some cases can be decreased to 5 minutes.
 2. It is provided 5-minutes break between periods.
 3. The stop-watch will be switched on for the full game duration (two 10-minutes periods), without stopping the time (excluding time-outs, taken by the referee – see Paragraph 4.9.4).
 4. According to the referee decision the team can be penalized by one goal for one-minute late attendance.
 5. If the team will not be ready for the game in 5 minutes after its starting the team will be considered as loosed the game with the score of 0:5.
 6. If goals difference in the match achieves 10, the match will be ended.
3. Game start.
 1. Before each match period the referee will spin a coin, and the first team in the list shall make its choice (heads or tails) and announce it when the coin is still in the air.
 2. The team, won the lot, can choose: (a) goals or (b) the first kickoff right.
 3. The team, lost the lot, has another choice.
 4. The team, that has not the first kickoff right in the first period, will do this in second period.
1. First kickoffs.
 1. Each period starts with the first kickoff.
 2. All robots shall be on their half of the playing field (in defense).
 3. Robots shall not move (wheels shall not rotate).
 4. The referee places the ball at the center of the playing field.
 5. The team having the first kickoff right places its robots on the field first. At that robots shall not move.
 6. All robots, excluding the robot that will do the first kickoff, shall be partly in the scoring-area.
 7. On a referee signal all robots shall be immediately started by the team member (person).
 8. Any robot, that has started the game before the referee signal, will be out for one minute.
2. Scoring.
 1. Goal will be scored if the ball entirely crosses the goal line. I.e. the ball shall hit the back goals wall. If goal is scored, the referee whistles.
 2. For the goal to be scored the ball shall roll in the goals freely. Otherwise the referee considers the ball to be pushed in and does not score it. In this case the game will be not stopped. Goal will be not scored. The ball will be placed in any nearest accessible neutral zone and the game will be continued. The robot shall make a visible action to kick the ball, otherwise it will be considered as "pushed in". I.e. if robot does not make any action to get free of the ball that freely rolls with the robot moving towards the goal, it will be considered that the robot pushed the ball in.*
 3. If the ball is in the goals, having bounced from the robot-defender, any part of which is on the goal line or in the «goal area», it will be scored. The robots shall be constructed so that the bar prevents its movement behind the goal line.
 4. After the scored goal the team conceded a goal starts the game from the field center.
 5. "Own goals" will be scored even if the balls were pushed in the goals.*

**The term of "pushed in" ball is not presented in the WRO 2013 rules, on the IRC it still will be presented.*

1. Blocking.
 1. Blocking is made in cases when the ball is stucked between between several robots for a long period of time ("problematic" situation) and in the foreseeable nothing can change it.
 2. In case of blocking the ball is placed in the nearest neutral zone. In case of blocking repeating the ball is placed at center of the field.
 3. In case blocking situation announcement, all robots will be moved apart by the referee or team captains for the minimum distance that is enough for the robots to start to move freely.
2. Fault robots.
 1. If the robot is not able to move independently and/or do not respond to the ball, the referee declares these robots as fault.

2. If one robot stays on the white side line or stuck somewhere and «is not going to» return to playing field, the referee declares this robot as fault.
3. The referee or players (after judge permission) can remove the fault robot (or robots) from the laying field.
4. The fault robot shall stay outside the playing field for at least one minute. In shortened (5-minutes) periods the fault robot can be replaced after made and scored goal.
5. The fault robot may be repaired and by authorization of referee returned to the neutral zone that is nearest to the goals that it defends, at that it will not be considered for example whether the robot was turned to the ball.
6. Goalkeepers is allowed to return to the playing field in any place in front of the goals (to the black penalty zone).
7. If the robot overturned after collision with other robot the referee can put it «on its feet» again and the robot will continue to play.
8. If the robot overturned "itself", it will be considered as fault and removed from the field.
3. The ball is in out
 1. The ball is considered to be in out if it hits the outer fencing wall or leaves the field.
 2. After «the ball is in out» announcement, it will be placed in the nearest neutral zone so that it will not be advantageous for the team the robot of which touch the ball last. I.e. in the neutral zone, located in the direction opposite to the kick direction.
4. Game stop.
 1. In the situations, described below in Paragraphs 4.6-4.8, the game may be stopped and the ball is placed in the nearest neutral zone where the game will be started again.
 2. Also the game stops on referee whistle (time-out), but at that the stop watch is not stopped – at the discretion of the referee. AT that moment all robots shall immediately stop and returned to the position where they were at the moment of the whistle.
 3. Stopped game resumes by the referee signal, at that all robots shall start simultaneously.
 4. The referee also can take a time-out ("Referees Time Out") to repair the playing field and also in the cases described in Paragraph 4.11.3, or if the referee is called to clarify the competition rules. If game stop is expending, the referee can stop the stop-watch.
5. Multiple Defense.
 1. Multiple defense means the situation when more than one robot of the defending team enter the penalty zone and exert decisive effect on the game.
 2. In case of "Multiple defense" the robot that makes the least contribution to the game, is placed at the center of the field. In situation with the goalkeepers other players will be moved.
6. Infraction.
 1. If the robot uses a device by means of which (or without it) regularly attacks robots that do not possess the ball, the referee fixes infraction ("Foul"). After that the team captain shall remove this robot from the playing field within one minute and clear the problem; after that the game will be resumed (according to Paragraph 4.7 "Fault robots").
 2. If the robot (robots) continues to "foul" it will be constantly removed from the field, the warning yellow card (sticker) will be hung on it, the referee will record these fouls in the match report.
 3. If as a result of foul the robot is damaged, the referee will stop the game and stop-watch (for 2 minutes WRO2013)-~~until the damage is not repaired~~ (see Paragraph 4.9.4 «Game stop»).
 4. If the robot was ejected from the game in two matches, it will be disqualified for the whole competition.
7. Free kicks. On this competition rules do not consider free kicks.
8. Penalty. On this competition rules do not consider penalty.
9. Offsides. On this competition rules do not consider offsides.
10. People participation in the competition.
 1. Generally it is not allowed people to move robots.
 2. People may move robots only in case of referee permission.
 3. Before each match start the teams shall assign "captain" from one of the team member. The captain is allowed to remove the robots from the playing field and substitute them during the game. Captains shall act strictly according to the specified rules and referee's directions.
 4. During the game other team members (when the ball is in the game) shall not approach to the playing field for one meter max. except the cases specified by the referee.

5. Contention resolution.

1. Referees.
 1. During the game referee's decisions are mandatory. Any disagreement with the referee's decision penalized with the warning (yellow? card?). If after that the conflict is not resolved the referee shows a red card that results in losing the game.
 2. If the teams' captains are satisfied with the game results, they sign the respective scoring and referee reports.
 3. Any protests after the game are accepted only if game's results are incorrect or cause doubts. After signing the match report protests are not accepted.
2. Rule clarification.
 1. Rules can be clarified only by WRO Football committee members.
 2. If it is necessary to clarify the rules the referee shall immediately stop the game, take a time-out (see Paragraph 4.9.4), stop the stop-watch and affirm a decision before game resuming.
3. Exceptional circumstances.
 1. In exceptional circumstances, appeared in case of unforeseen robot problems and/or difficulties, under agreement of counter parties special correction may be made in competition rules (during the competition).

6. Checks.

1. Observers.
 1. All robots will be checked by the jury at each competition day beginning to ensure that all robots comply with the all requirements specified in Section 3.
 2. The teams are obliged to provide their robots for recheck if they did not pass the the jury check or their construction has been changed during the competition.
 3. In case of check rule violation the robot will be excluded from the competition until carried out modification influence on the robot actions.
 4. All modifications shall be made within the period of time specified in the competition regulations. The teams shall not delay the game because of introduction of modifications.
 5. If the robot does not comply with the technical requirements (even with the modifications) this robot will be disqualified for the current game (but not for the whole competition).
2. Pupils.
 1. Pupils are asked to explain how their robot functions to ensure that they constructed and programmed their robots independently.
 2. Pupils will be asked the questions concerning how they carried out the preparatory works. It will be a questionnaire and recording the video interview that are necessary for research purposes.
 3. It shall be provided documents (photos, logs, posters and plans etc.) affirming that robots are constructed and programmed by pupils. Minor changes description is not required. It is necessary to provide the evidences of full understanding of the presented program.
 4. It is suggested the competition organizers will conduct this test interviews before final games beginning.
 5. In case of check rule violation the robot will be excluded from the competition until carried out modification influence on the robot actions.
 6. All modifications shall be made within the period of time specified in the competition regulations. The teams shall not delay the game because of introduction of modifications.
 7. If the robot does not comply with the technical requirements (even with the modifications) this robot will be disqualified for the current game (but not for the whole competition).
 8. If it is found that pupil had significant assistance of the teachers during robot designing this team will be disqualified for the whole competition.

7. Code of behaviour.

1. Fair play.
 1. Robots, that during the game intentionally and repeatedly cause the damages of other robots, will be disqualified (see Paragraph 4.11).

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2. Robots that during the game damage the playing field will be disqualified (see Paragraph 3.8).
3. People that intentionally effect on any robots or damages the playing field or the ball will be disqualified.
4. It is suggested that the aim of all teams is fair "robotics football" play.
2. Competitors behaviour.
 1. All competitors shall suppress their emotions in places of competition.
 2. Competitors shall not enter other playing field to set up robots excluding the cases when they are directly invited by other team members.
 3. Competitors that behave improperly may be asked to leave the place of competition and they risk to be disqualified for the whole competition.
 4. These measures may be applied on the decision of referees, competition organizers supervisors and local authority representatives.
3. Supervisors-tutors (mentors).
 1. Supervisors-tutors (teachers, parents, accompanying persons and other adults - team members) have no right to enter pupil working areas.
 2. Supervisors-tutors will be provided with the enough number of seats around the pupils working areas to have the possibility to supervise the pupils.
 3. Supervisors-tutors have no right to participate in robot repair or programming carried out by the pupils. The robots shall not leave the pupils' working areas during the whole competition day.
 4. Supervisor-tutor interference in works on the robot or referees' decisions for the first time will be penalized with the warning (yellow card). In case of these fouls repeating it will be shown a red card and the rule-breaker will be asked to leave the place of competition.
4. Publications.
 1. Teams will be encouraged for competition materials posting on YouTube using WRO GEN II Soccer tags. For the best clips special prizes will be awarded by the competition organizers decision.
5. Competitive spirit supporting.
 1. It is suggested that all competitors both pupils and tutors will respect the aim of WRO Olympic.
 2. Referees and official Olympic committee representatives will act according to the competition spirit.
 3. It does not matter whether you won or lost the only important thing is what you have learned.