LEGO League Soccer

[Draft] Last updated January 2019

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INTRODUCTION

Please keep track of rule revisions and news at `https://stormingrobots.com/blog/category/lego-soccer/`. Please post any questions on the forum at `https://stormingrobots.com/robotalk/viewforum.php?f=183`.

1 ROBOT

1.1 Construction

1.1.1 The mass of a robot may not exceed 1.5kg (3.3lb).

1.1.2 The diameter of a robot may not exceed 9in (23cm), that is no two lateral points on the robot may measure more than 23cm.

1.1.3 The height of a robot may not exceed 9in (23cm).

1.1.4 Robots must be constructed with Lego parts or non-machined/manufactured parts (the use of 3D printing, CNC, etc. is not allowed). Allowed parts include but are not limited to cardboard, fishing line, adhesives, etc.

1.1.5 Robots may not be contracted with parts that are the color of the goals or ball. In essence, they may not be blue, orange, or yellow.

1.1.6 Robots must have a handle which allows the referee to easily lift a given robot. The handle must stand upright, and may exceed the maximum height of a robot. The handle may not have any sensors or motors attached.

1.2 Hardware Platform

1.2.1 Robots may be controlled only by a singular LEGO Mindstorms RCX, NXT, or EV3.

1.2.2 Robots may only use first party sensors or those on the attached approved list.

1.2.3 Robots may only use cameras on the attached approved list.

1.2.4 Sensors (including cameras) and motors may not be modified in any way from their stock condition except structurally, such as removing external casing.

1.2.5 Robots may only use first party motors.

1.3 Software Platform

1.3.1 Robots may be programmed using any IDE and firmware, including but not limited to NXT-G, the native EV3 language, ROBOLAB, ROBOTC, and ev3dev.

1.4 Control

1.4.1 Robots must be able to run in full autonomous mode, that is, without human interference (other than stopping and starting the program).

1.4.2 The use of wireless or manual control mechanisms, including but not limited to remote controls, wired controller, etc. is strictly forbidden.

1.4.3 Robots in the Full Game League may use wireless communications (which is in contradiction to Rule 1.4.2), but only when for communications between only their striker and goalie robot. Unless it is proven that communication is between the striker and goalie, there will be no wireless communication and Bluetooth capability will have to be disabled during the round.

2 FIELD

2.1 Construction

2.1.1 The game field will measure 4ft by 6ft (1.2m by 2.4m). The mat itself may extend larger but the walls will bound the playing area by those dimensions.

2.1.2 The game field will be surrounded by a white wall measuring at least 5.9in (15cm) in height.

2.1.3 The flooring of the game field will partially mimic that of an actual soccer field, being green in color and possessing the appropriate markings for the goal line (in front of the goals, bounding the shorter side), penalty box, and halfway line.

2.1.4 The penalty box will extend 1ft (30cm) in front of a goal and 1ft (30cm) to the sides of the center of a goal.

2.2 Goals

2.2.1 There will be two goals, with one colored blue and the other colored yellow.

2.2.2 The front of each goal will be positioned 1ft (30cm) away from the two shorter walls, centered relative to the two longer walls, facing the center.

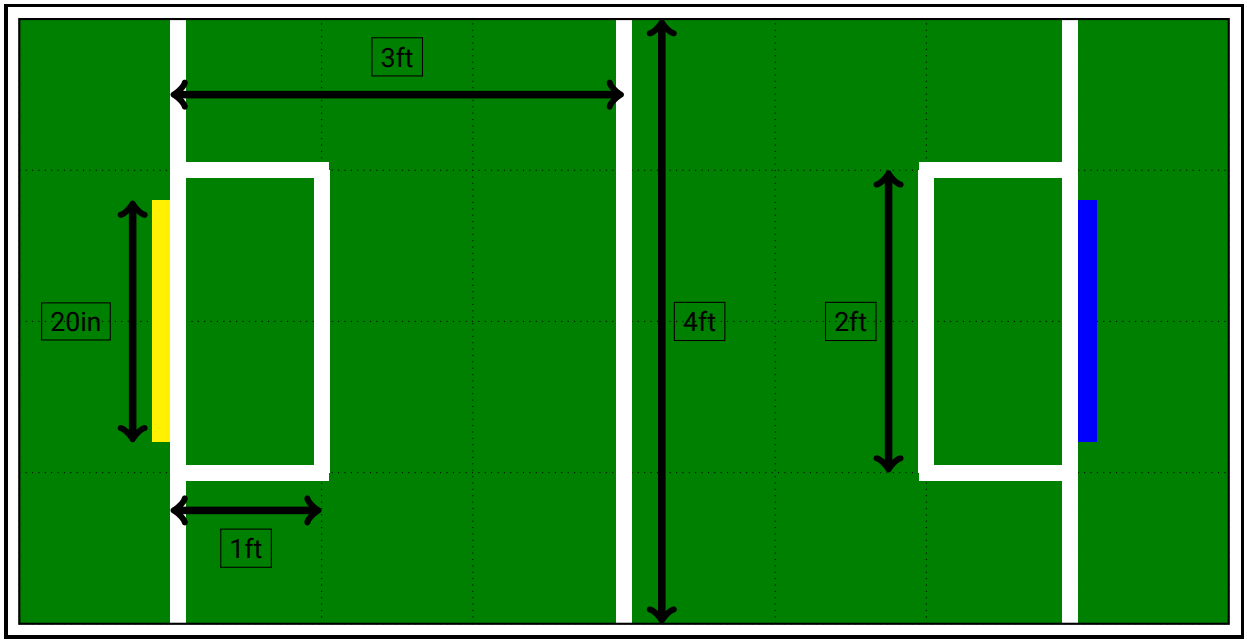
2.2.3 Each goal will be 19.7in (50cm) wide.

2.2.4 The goals will be affixed to the ground.

2.3 Ball

2.3.1 The ball will be 2.5in (6.4cm) in diameter, colored orange, and have a mass of approximately 60 grams (0.13lb).

2.4 Diagram



1 grid line interval (denoted by the dotted lines) = 1ft

2.5 Tolerance Margin

2.5.1 All measurements regarding the field are subject to up to a 5% margin of error.

2.5.2 Note that the game field may not be perfectly flat due to assembly imperfections. Any bumps in the field will not exceed more than 3mm (0.1in).

3 Game Modes

Introduction

In order to promote the participants of different levels of experience, the competition divided into 3 separate leagues, Free Kick League, Goalie League, and Soccer League. The hope is that newer teams can develop a robot that completes part of the full game so that they can not only participate, but also have a foundation for future years of participation.

3.1 Participation

3.1.1 Teams participating in the Soccer League cannot compete in Free Kick League or Goalie League. A team may still compete in both the Free Kick and Goalie Leagues.

3.2 General

3.2.1 All rules of the full game (Section 4) as well as other sections apply unless they are in direct contradiction to the specific rules below.

3.3 Free Kick League

3.3.1 There will be 3 levels of differing difficulty (referred to as difficulty 1, 2 and 3).

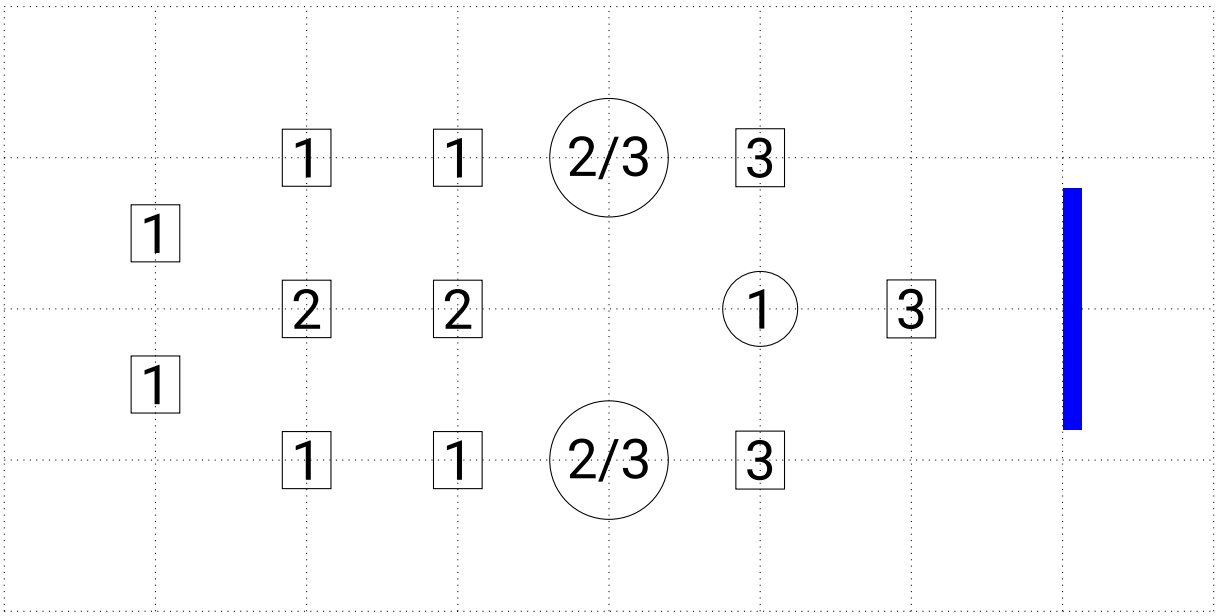
3.3.2 Each team will attempt two free kicks per level of difficulty, equating to six total free kicks.

3.3.3 Each attempt at a free kick will be given at max 30 seconds.

3.3.4 There will be only 1 goal, colored blue.

3.3.5 The initial ball and position will be determined by a dice roll under the following schema, and where the placement of a number (1, 2, or 3) in a circle or box represents a possible placement of the ball or robot respectively for the given difficulty level.

For example if the difficulty level is 2 then the ball will be placed in one of the two circles with a 2 in it and the robot will be placed on one of the squares with 2 in it.



1 grid line interval (denoted by the dotted lines) = 1ft

3.3.6 The starting orientation of the robot will be decided upon by the referee. The method of deciding the direction will be unbiased and uniform across all teams' attempts.

3.3.7 **Scoring** The Free Kick League score will be the number of successful free kicks weighted by the difficulty (1 point for difficulty 1, 2 for difficulty 2, etc). The max score is therefore 12 points.

For example, if a team scores twice for the first difficulty, once for the second difficulty, and once for the third difficulty, their score would be 1 + 1 + 2 + 3 = 7 points.

3.3.8 In the case of a tie, the team with the lowest combined time will win.

3.4 Goalie League

3.4.1 There will be 3 levels of differing difficulty (referred to as difficulty 1, 2 and 3).

3.4.2 For each level of difficulty, there will be two blocking attempts.

3.4.3 The speed of the ball is determined by the difficulty level - the higher the difficulty, the higher the speed. 1—0.25 m/s; 2—0.5 m/s; 3—1 m/s

3.4.4 The ball speeds mentioned in Rule 3.4.3 are subject to a $\pm$10% margin of error

3.4.5 For each attempt, the ball will be rolled from a random location 100cm away from the wall corresponding to the goal.

3.4.6 Both goals will be present.

3.4.7 At the start of each attempt, players may place the robot down at any position within a penalty box.

3.4.8 The robot will defend the goal associated with the penalty box it's placed in.

3.4.9 **Scoring** The Goalie League score will be the number of successful blocks weighted by the difficulty (1 point for difficulty 1, 2 for difficulty 2, etc). The max score is therefore 12 points.

For example, if a team blocks sucessfully twice for the first difficulty, once for the second difficulty, and once for the third difficulty, their score would be 1 + 1 + 2 + 3 = 7 points.

3.5 Full Game League

3.5.1 See Section 4

4 Game

4.1 Ball

4.1.1 The ball will be 6.4 cm diameter, colored orange, and have a mass of approximately 60 grams

4.2 Scoring

4.2.1 When the ball touches the back wall of a team's goal, the opposing team earns a point

4.3 Goalkeeper

4.3.1 A team's goalkeeper robot is the team's robot currently inside of the penalty box area for their goal, or, if both robots are in the area simultaneously, the first robot to enter the area.

4.3.2 A striker robot cannot remain in its own team's penalty box for more than two (2) seconds. In other words, there cannot be more than one robot per team in that team's own penalty box.

4.3.3 Striker robots may enter their opponent's penalty boxes, provided they do not interfere with the opposing goalkeeper (see Rule 4.3.4)

4.3.4 Opposing teams' robots must not intentionally push a team's goalkeeper robot.

4.4 Ball Movement

4.4.1 The robot may only contact the ball at a single point of contact.

4.4.2 Whenever touching the ball, the striker robot must not be enclosing the ball in any way (have any pieces directly to the side, above, or below the ball).

4.4.3 The striker may not lift the ball, that is apply a sustained vertical force on the robot.

4.4.4 The goalie robot may enclose or lift the ball, however in the case that it does it must be for a duration of 5 seconds or less.

4.5 Start of play

4.5.1 The ball will start at the exact center of the field

4.5.2 Robots will be placed on their respective sides of the field in any position at least 1 ft (30.4 cm) from the ball the team members choose.

4.5.3 Each team will start their robots on the referee's signal

4.6 Lack of Progress

4.6.1 When a ball lack of progress is called, the ball will returned to the center of the field by the referee.

4.6.2 If the ball is stationary for more than 5 seconds without any robot moving towards it, a ball lack of progress will be called. This also includes situations where a ball is stuck between two robots, with both robots exerting equal opposite forces upon it without resolution.

4.6.3 If any situation arises such that both teams and the referee agree is clearly a stuck state, a ball lack of progress may be called.

4.6.4 When the ball becomes stuck or stationary, the referee will clearly count out loud to 5 seconds. If the count finishes and the situation is not resolved, a ball lack of progress occurs.

4.6.5 At any point in the game, if a team believes their robot (striker or goalie) is in a stuck state, they may call a robot lack of progress

4.6.6 When a robot lack of progress occurs, the team will pick up their robot. The referee will count 10 seconds. After the count, the team will place their robot in its starting position.

5 Technical Interview

Introduction

There will be a technical interview that involves the answering of questions in front of a panel of judges and engineering journal/documentation submission. Teams will be graded primarily on the quality of their documentation, knowledge of their code, quality of algorithmic implementation, and presentation cohesiveness. This portion of the competition will count for part of the team's final grade in the competition.

6 Code of Conduct

6.1 Individual Work

6.1.1 All work must be done by the competing team members.

6.1.2 Work from departed team members and mentors are not allowed.

6.1.3 Teams may not be given technical assistance by mentors at the venue of the competition.

6.1.4 All hardware and software design must be of the team members' own making. Competitors may not use another party's robot design or code (excluding device drivers and such).

6.1.5 Any teams found to have gotten outside help, whether it is displayed in the technical interview or otherwise, may be subject to penalty or disqualification.

6.2 Behavior

6.2.1 Competitors are expected to act with courtesy and sportsmanship at all times, with the mindset of learning, not winning.

6.2.2 Disrespectful behavior against other teams, spectators, judges, or staff will not be tolerated.

6.2.3 Actions that impact the operation of opposing robots are strictly prohibited.

6.2.4 Competitors are expected to respect all the rules of the competition fully. If a rule is unclear, competitors must contact the organizers for clarification or else it will be at the organizer's discretion whether or not a rule is violated.

6.2.5 Design features or actions that obviously and intentionally circumvent the spirit of the competition are not allowed, even if not explicitly stated in the rules.

6.2.6 Failure to behave in an appropriate manner may yield a penalty or disqualification.

A Committees

Technical Committee

Daniel Xue (danielxue@stormingrobots.com)

Ethan Wu (ethanwu@stormingrobots.com)

Advisors

Elizabeth Mabrey (emabrey@stormingrobots.com)

B Allowed Hardware Devices

B.1 Sensors

B.1.1 All Mindsensors EV3/NXT sensors, multiplexers, and adapters, and flexi-cables

B.1.2 All HiTechnic EV3/NXT sensors

B.2 Cameras

B.2.1 NXTCam (all versions)

B.2.2 PixyCam