



World Robot Olympiad 2019

WeDo Regular Category

Game Description, Rules, and Scoring

SMART CITIES

DRIVERLESS SCHOOL BUS

Version: January 15th



WRO International Premium Partners



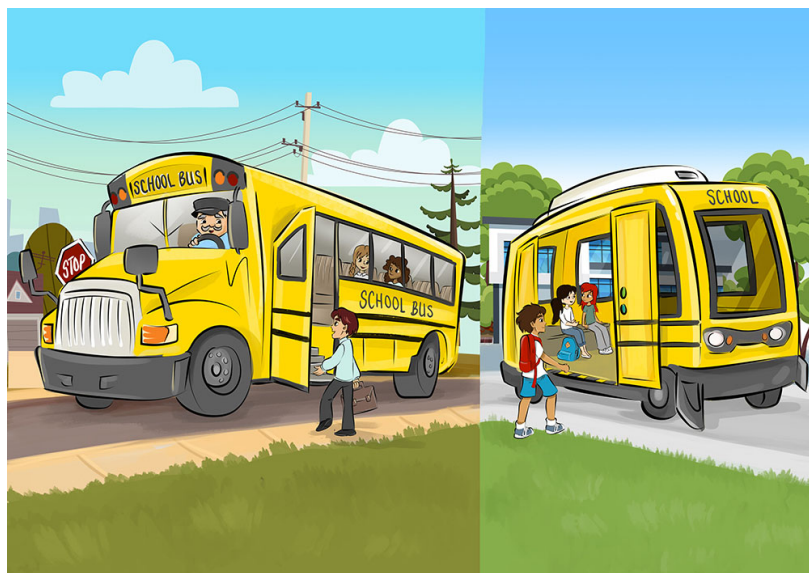
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Introduction

In smart cities of the future, the technology of driverless cars might also be used to redesign school busses as autonomous and electric vehicles, i.e. driverless school busses. The driverless school bus will pick the children up directly at their house and drop the children off at school. Since driverless school busses are only in use for short times of the day, a driverless school bus can also be used as a delivery van, e.g. to deliver food to the school.

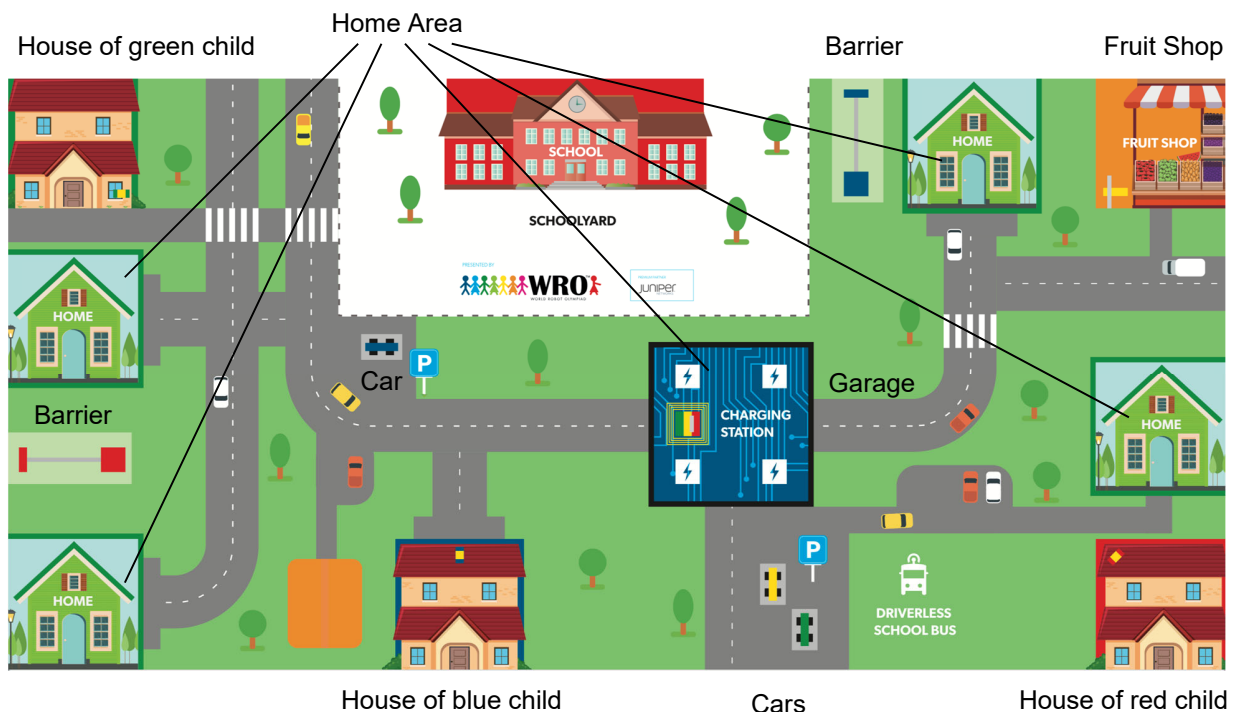
This year, the challenge is to make a robot that can pick up children at their houses and transport the children to school. Furthermore, the robot must also be able to deliver fruit to the school.



1. Game Description

The WeDo Regular Challenge is for each team to build and program a WeDo 2.0 robot to complete a series of tasks within a Game Table. The main task is to make the robot collect three children from their homes and transport the children to the school. In addition, the robot should transport fruit to the school. Finally, the robot should park in a garage for maintenance and to recharge. Each team will use their robot to perform the tasks within 2 minutes.

Game Field:



On the game field:

- There are five Home Areas: The four squares delimited with a dark green line and the square delimited with a black line. The black delimited square is also called the Garage. There is a Charging Station within the Garage.
- There are three Houses with a school child living in each House.
- There is a School surrounded by a Schoolyard - the dotted rectangle.
- There is a Fruit Shop. Inside the Fruit Shop there is a piece of fruit.
- There are three cars and two barriers.



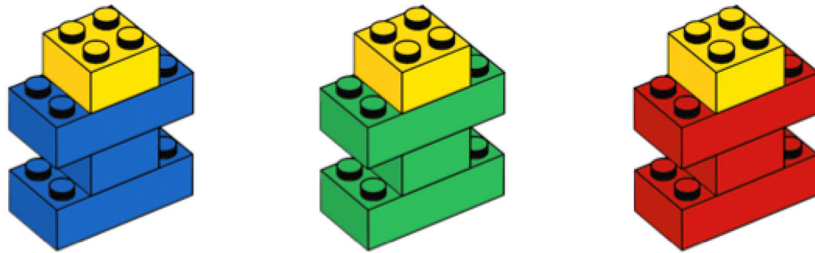
WRO 2019 - Regular Category - WeDo

For more information about the game table and game mat specifications, please take a look at WRO Regular Category General Rules Rule 4. The printable file of the mat and a PDF with the exact measurements are available on www.wro-association.org.

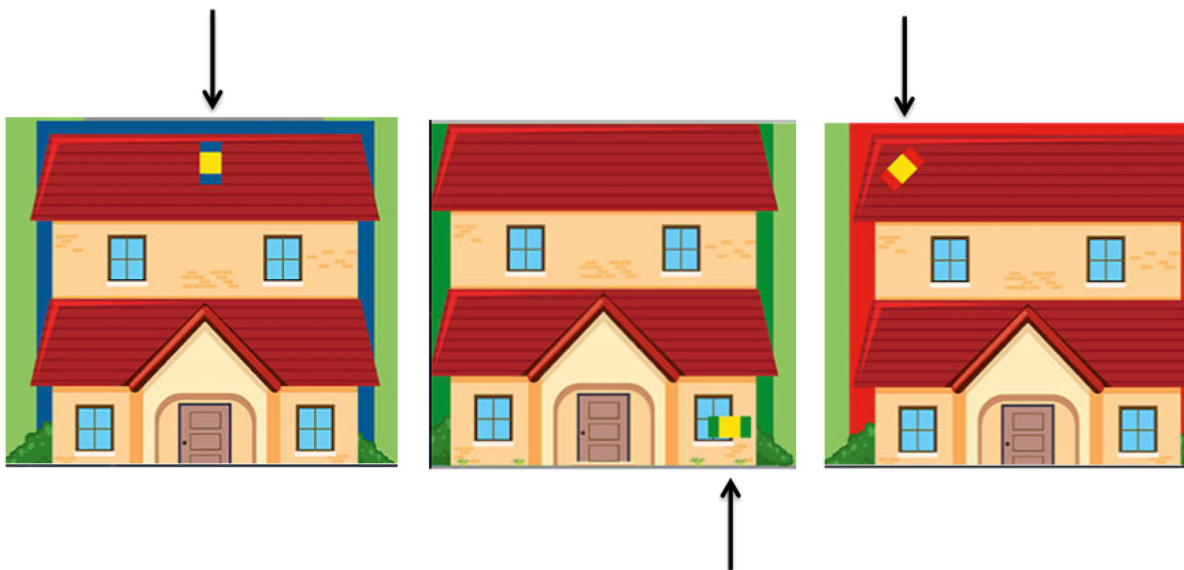
If the game table is larger than the game mat, use the House of the red child in the lower right corner as a guide and place the House of the red child at the corner of the edge walls to set up the game mat.

Game Objects:

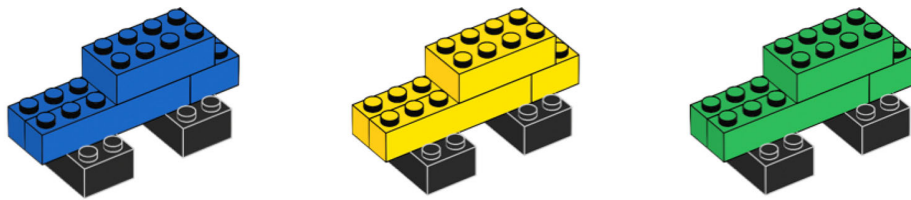
On the game field, there are three children represented by three different colored LEGO figures:



The three children are placed in the three houses on the game field: The blue child is placed in the House of the blue child oriented as shown in the blue/yellow figure in the House, the green and red children are placed in the House of the green child and in the House of the red child in a similar way:



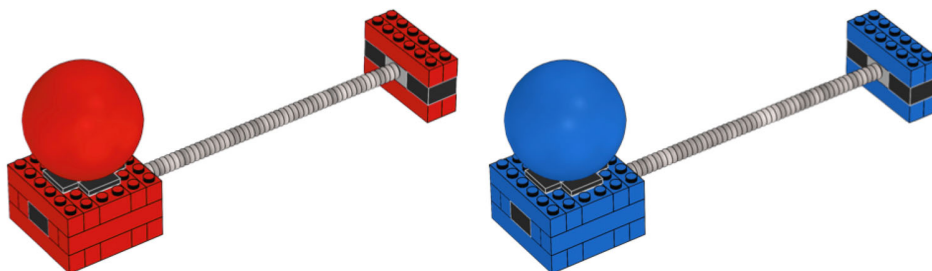
There are three cars on the game field represented by three different colored LEGO car models:



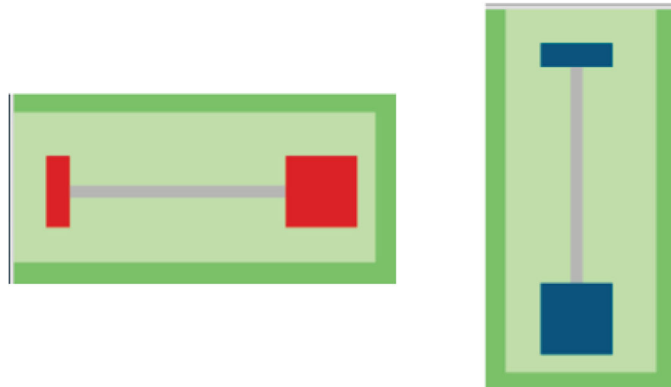
The blue car is placed oriented as shown in the blue/black figure inside its parking place, the light grey rectangle. The yellow and green cars are placed in a similar way in the other two parking places marked by light grey rectangles:



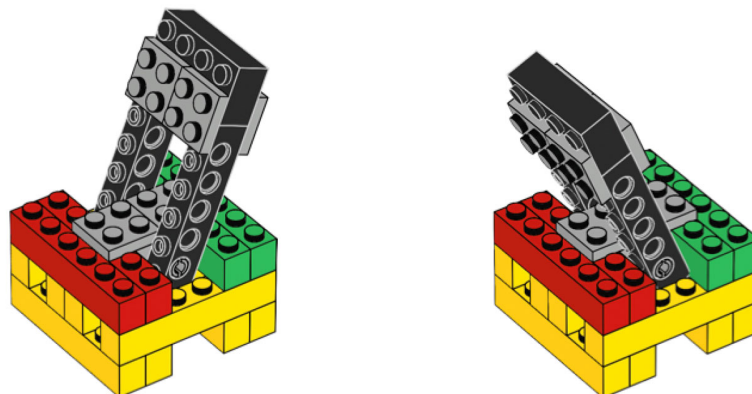
There are two barriers on the game field represented by a red and a blue LEGO model:



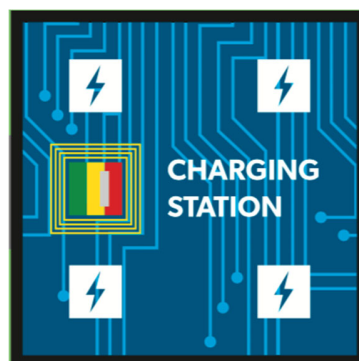
The two barriers are placed oriented as shown in the red/grey and blue/grey figures inside the two light green rectangles:



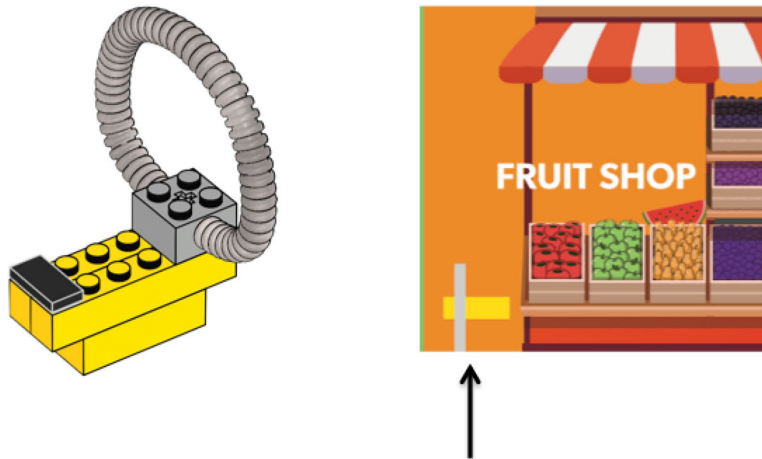
There is a charge station on the game field represented by a LEGO model that can be in two different states: On and off:



The Charging Station is placed within the Garage oriented as shown in the green/yellow/grey/red figure inside the Garage. Note that the Charging Station starts in the off position:



There is a piece of fruit inside the Fruit Shop. The piece of fruit is placed oriented as shown in the yellow/grey figure inside the Fruit Shop:



Game Tasks:

The robot must start from within one of the five Home Areas inside the green line/black line and should finish in the Garage.

During the competition, each team will use their robot to:

- Transport the three children from their Homes to the Schoolyard.
- Transport the piece of fruit from the Fruit Shop to the School.
- Make the robot blink and sound a warning signal during the transportation of the fruit through the Schoolyard.
- Turn the Charging Station on when the robot drives into the Garage and finishes.
- Drive safely, avoiding moving the barriers and the parked cars.

2. Game Rules

1. Before each attempt, the three children are placed in their Homes, the three cars are placed inside their parking areas, the two barriers are placed in their designated positions, the piece of fruit is placed in the Fruit Shop, and the Charging Station is placed in the Garage in the off state.
2. The robot must start an attempt from within any one of the four Home Areas that is not the Garage. The robot must start inside the green/black line.
3. During the attempt, the robot may be moved/operated under programmed control autonomously or under remote control, or using a combination of the two methods.
4. The robot can be controlled by any compatible device or with a remote controller built from WeDo 2.0 elements. The teams can use any software.
5. The three children must be moved outside of their Homes by the robot. There is no restriction on the way a child is moved outside of its Home.
6. Once a child is moved outside of its Home, it must be transported to the Schoolyard. A child is correctly transported to the Schoolyard if it is placed completely within the dotted rectangle and the child is not touching the School.
7. The piece of fruit must be moved outside of the Fruit Shop by the robot. There is no restriction on the way a piece of fruit is moved outside of the Fruit Shop.
8. Once the piece of fruit is moved outside of the Fruit Shop, it must be transported to the School. The piece of fruit is correctly transported to the School if it is placed completely within the School.
9. During the transportation of the piece of fruit through the Schoolyard the robot must blink and sound a warning signal.
10. During an attempt, the team is allowed to touch/grab the robot when any part of the robot, e.g. a wheel, touches a Home Area. A team may do this *either* to reposition the robot within the Home Area *or* to attach or detach appendages. The team is also allowed to move a robot from one Home Area to another Home Area.

11. During an attempt, members of the team are:

- *Not allowed to touch a barrier, a ball rolling off a barrier, a car, or the Charging Station.* If a team touches a barrier, a ball rolling off a barrier, a car, or the Charging Station, the judge will place the touched item at the location on the field where it was located when the team touched the item and in the state it was when touched.
- *Not allowed to touch the robot unless the robot is touching a Home Area.* If a team touches a robot which is not touching a Home Area, the judge will replace the robot at the location on the field where it was located when the team touched the robot.
- *Not allowed to touch a child or the piece of fruit unless they are within a Home Area.* If a team touches a child or a piece of fruit not within a Home Area, the judge will replace the child or the piece of fruit at the location on the field where it was located when the team touched the item.

12. The mission is completed when either:

- The robot moves to the Home Area called the Garage, stops, the chassis of the robot is completely within the Home Area (cables are allowed to be outside of the Home Area) and the team communicates to the judge that the robot has finished. The Charging Station may be switched to the on state for additional points.
- The 2-minute time limit has expired.

13. Information about our WRO Guiding Principles and WRO Ethics Code:

- By competing in WRO, teams and coaches accept the WRO Guiding Principles that can be found at: <https://wro-association.org/competition/wro-ethics-code/>
- Every team needs to bring a signed copy of the WRO Ethics Code to the competition and hand it to the judges before the start of the competition.

3. Evaluation

The overall evaluation of the teams in WeDo Regular is broken down into two categories:

- **Understanding:** through a dialog with the team members, the judges assess their understanding of the building process, the program, and the strategy used on the game field.
- **Score:** the points scored on the game field.

The team must be assessed well in both categories to be evaluated as a high performing team.

Assessment of Understanding:

Before the first attempt on the game field, each team is interviewed by the judges to assess how well **all** team members understand the building process, the program and the strategy used on the game field. The following table can be used to assess the teams. For each entry in the table, a smiley from a three-level smiley scale is chosen as the assessment of the entry in question.



Robot build: how well do the team members understand the components of the robot build, and the reason for having each component?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Program: how well do team members understand the program and the correspondence between the components of the program and the behavior of the robot on the game field?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strategy: how well do team members understand the strategy chosen for getting points on the game field?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The dialog with judges showed that the team has built and programmed the robot themselves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In total			

Assessment of Points Scored:

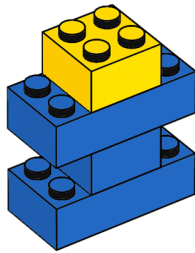
Maximum score = 150 points. If a team illegally touches a barrier, a ball rolling off a barrier, a car, the Charging Station, a robot, a child, or the piece of fruit, a penalty of 1 point is subtracted from the score unless the score becomes negative.

Point Scoring Table:

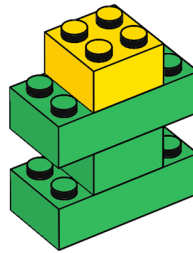
Tasks	Each	Total
A child is completely removed outside of its Home by the robot.	5	15
The piece of fruit is completely removed outside of the Fruit Shop by the robot.		5
A child is completely within the dotted rectangle (Schoolyard) and not touching the School.	10	30
Three children are completely within the dotted rectangle (Schoolyard) and not touching the School.		10
A child is completely within the dotted rectangle (Schoolyard) and touching the School.	5	15
The piece of fruit is completely within the School.		10
The piece of fruit is completely within the dotted rectangle (Schoolyard) and not completely within the School.		5
During the transportation of the fruit through the Schoolyard the robot is blinking and sounding a warning signal.		10
Each ball not removed from the barrier where it was located initially. (Only gets these points if other points are assigned)	5	10
Each barrier or car not moved completely outside its designated grey rectangle where it was located initially. (Only gets these points if other points are assigned)	5	25
Robot completely stops within the Garage. (Only gets these points if other points are assigned)		20
The Charging Station is completely in the Garage and turned on when the robot completely stops within the Garage. (Only gets these points if other points are assigned)		15
Maximum Score		150

4. Game Object Specifications

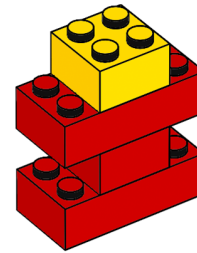
There are 3 LEGO children, each built with 2 2x4 LEGO bricks and 2 2x2 LEGO bricks:



Blue child

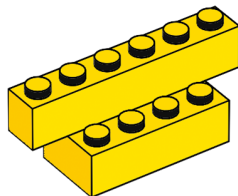


Green child

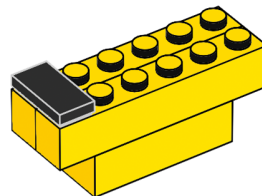


Red child

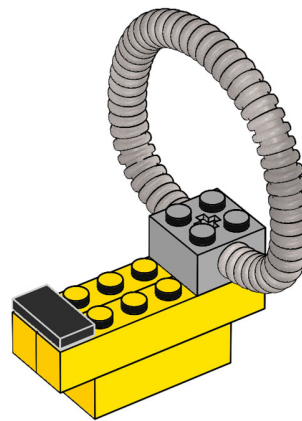
The piece of fruit, a LEGO banana, has 1 yellow 2x4 LEGO brick, 2 yellow 1x6 LEGO bricks, 1 modified 2 x 2 with pins and axle hole, 1 grey corrugated pipe and 1 black 1x2 LEGO tile:



Step 1

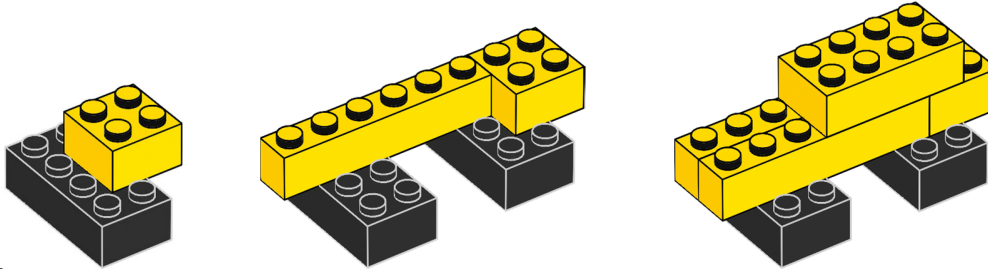


Step 2



Step 3

The yellow LEGO car is built out of 2 black 2x4 LEGO bricks, 1 yellow 2x2 LEGO brick, 1 yellow 2x4 brick, and 2 yellow 1x6 LEGO bricks:

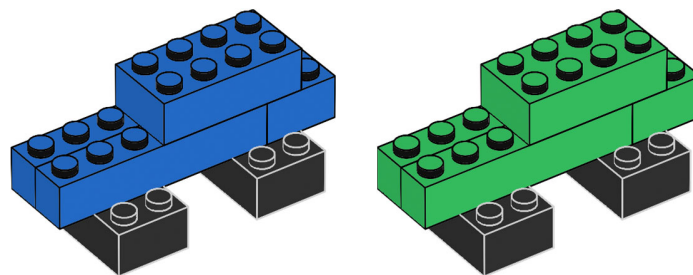


Step 1

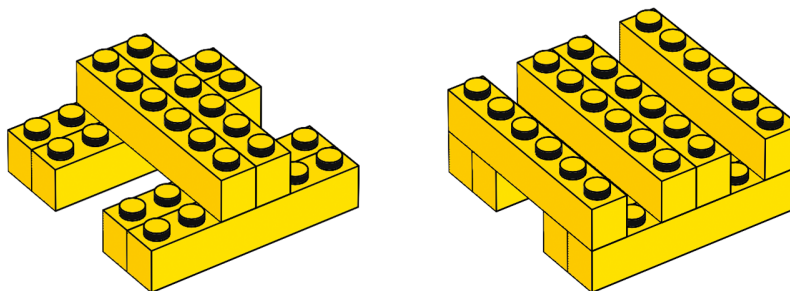
Step 2

Step 3

The blue and green car are built in a similar way:

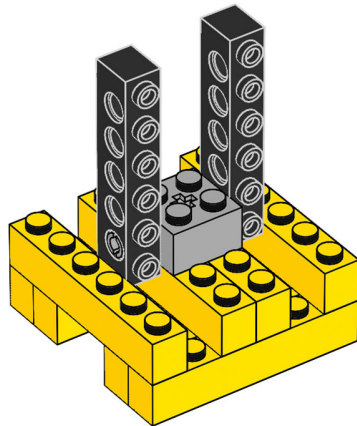


The Charging Station has 8 yellow 1x6 LEGO bricks, 1 modified 2 x 2 with pins and axle hole, 2 black 1x6 LEGO technic bricks with holes, 6 grey 2x2 LEGO plates, 1 black 2x4 LEGO brick, 2 green 1x6 LEGO bricks, and 2 red 1x6 LEGO bricks:

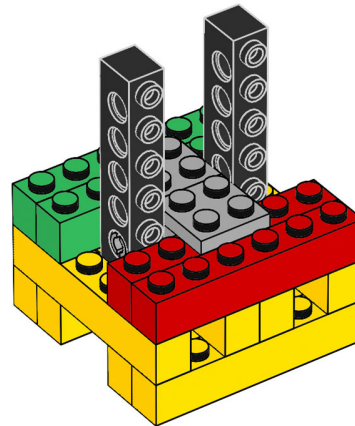


Step 1

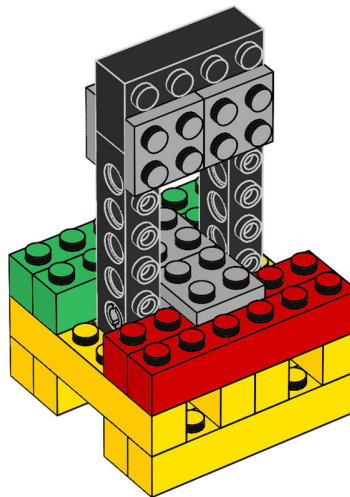
Step 2



Step 3

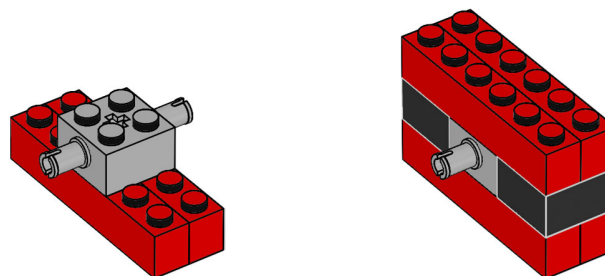


Step 4

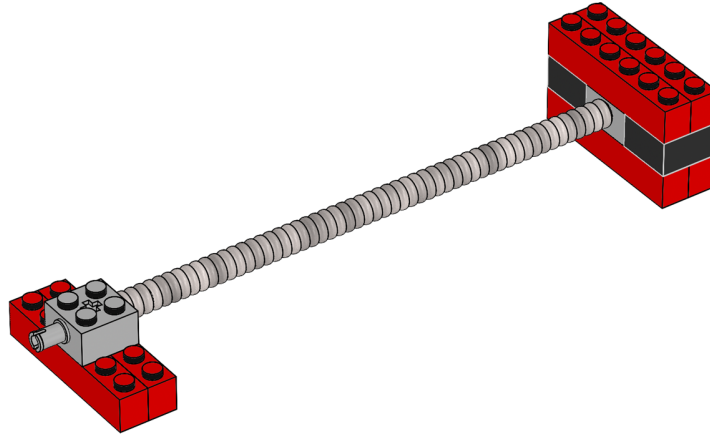


Step 5

The Red Barrier is built out of 2 modified 2 x 2 with pins and axle hole, 16 red 1x6 LEGO bricks, 4 red 2x2 LEGO bricks, 3 black 2x2 LEGO bricks, 1 grey corrugated pipe, 4 1x2 LEGO plates and 1 red LEGO ball:

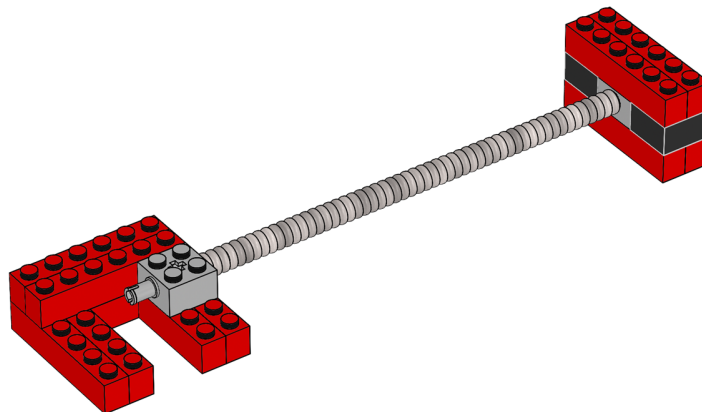


Step 1

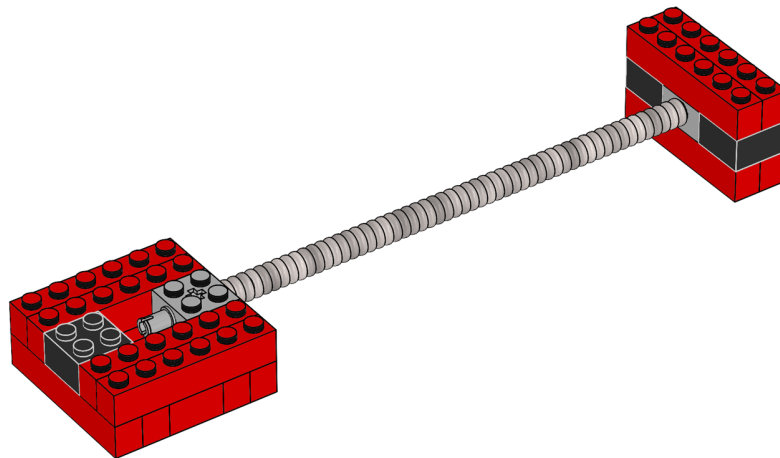


Step 2

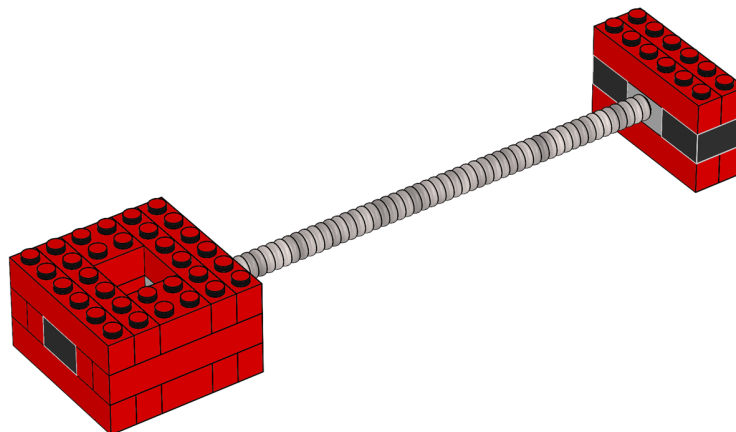
Step 3



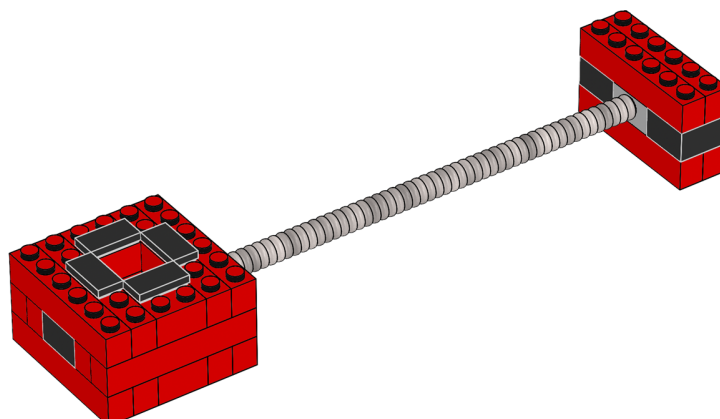
Step 4



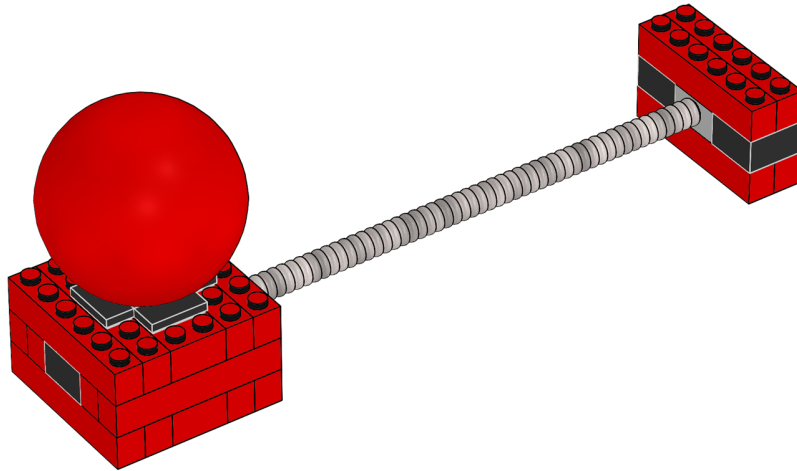
Step 5



Step 6

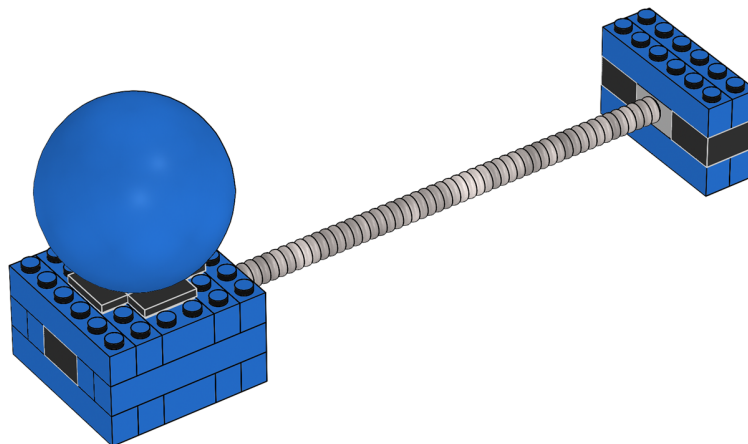


Step 7



Step 8

The Blue Barrier is built in a similar way:



5. WRO Regular General Rules

1. Each team has two or three team members and is assisted by a coach. The age of the team members is up to 10 years old.

Material

2. The controllers, motors and sensors used to assemble the WeDo robot must be from the LEGO Education WeDo 2.0 Core Set. Any number and combination of controllers (Smarthubs), motors and sensors are allowed. Any LEGO branded non-electrical/non-digital elements can be used in the construction of the robot.
3. Only one WeDo robot is allowed on the Game Table during an attempt to solve the challenge.
4. The maximum dimensions of the robot before it starts must be within 250mm×250mm×250mm. After the robot starts, the dimensions of the robot are not restricted.

Competition

5. All the teams in a competition each have the same number of attempts to solve the challenge. The local organizers or the National Organizers decide the format of the competition: when to schedule the competition, the number of attempts for each team and the way the score for each attempt is used to get the overall score for each team and hence how the winning team is found.