



## **World Robot Olympiad 2019**

WeDo Open Category

Game Description, Rules and Evaluation

### **SMART CITIES**

# **DRIVERLESS SCHOOL BUS**

Version: January 15<sup>th</sup>



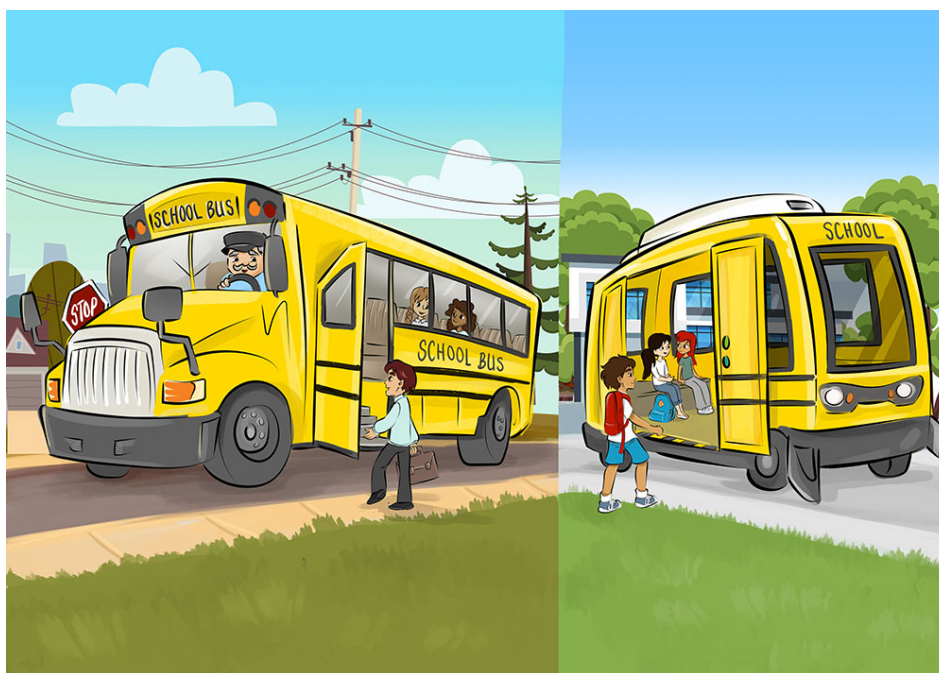
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## Introduction

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 homes 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's challenge is to make an exhibit that illustrates, explains, and demonstrates how a driverless school bus can pick up children at their homes and transport them to school. It might also show how a driverless school bus can be used as an autonomous delivery van.

## 1. Challenge Description

The WeDo Open Challenge is for each team to use WeDo 1.0/2.0 elements to construct a model of a driverless school bus that the team can use to illustrate, explain, and demonstrate how a driverless school bus works, how the school bus autonomously transports children from their homes to school, and how the bus can be used as an autonomous delivery van. The constructed driverless school bus must be placed in an exhibit booth and the team must be ready to demonstrate it for visitors and judges.



## 2. Challenge Tasks

Each team must complete a series of tasks in the process of making an exhibit. Each task in the sequence must be documented with pictures/video/text displayed in the exhibit.

## Task 1 - Autonomous Emergency Braking

When an autonomous, driverless car detects an obstacle in front of the car, the car stops to avoid a collision:



Task 1 is for the team to use the WeDo elements to build and program a mobile WeDo car with one motor and one motion sensor e.g. like Milo the Science Rover:



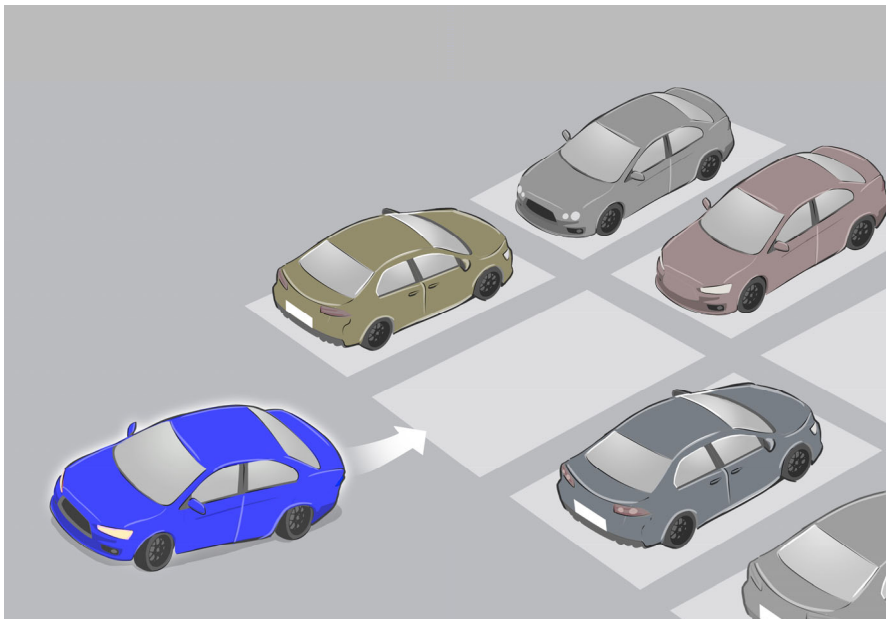
The team must use the mobile WeDo car to demonstrate what autonomous emergency braking is. The mobile WeDo car must be programmed to autonomously drive forward until the motion sensor mounted on the car detects an object in front of the car. When an object is detected, the car must stop. The autonomously driven car must be controlled by a sequence of WeDo commands that, once activated, make the car drive on its own, i.e. the car must not be remotely controlled.

When the WeDo car is built and programmed, the team must make a video that shows how the mobile WeDo car performs autonomous emergency braking. The

video must be shown in the exhibit, together with the program that controls the WeDo mobile car on the video.

## Task 2 - Automatic Parking

When a driver drives the car into a parking place, the driver performs a sequence of car maneuvers to park the car. If the car is equipped with an automatic parking option, the driver can turn the automatic parking on so the car can perform the parking maneuvers autonomously without the driver controlling the car:



Task 2 is for the team to use the WeDo elements to build and program a mobile WeDo car that the team can use to demonstrate what automatic parking is. The mobile WeDo car must be programmed to automatically perform a sequence of maneuvers so the car parks in a parking place. The team must also design and build their own parking place to be used for task 2.

When the WeDo car is built and programmed, the team must make a video that shows how the mobile WeDo car performs the automatic parking maneuver. The video must be shown in the exhibit, together with the program that controls the WeDo mobile car on the video.

### **Task 3 – Experience the Inside of the Driverless School Bus**

When children are transported from their homes to school by a driverless school bus, they will spend time together in the bus.

Task 3 is for the team to imagine how the inside of the driverless school bus should be equipped and decorated so that the trip from home to school is fun / pleasant / comfortable / entertaining / interesting / etc.

In the process of imagining the inside of the school bus, the team can use text / sketches / drawings / models to express their ideas about the equipment and decoration of the inside of the school bus. The text / sketches / drawings / models must be shown as part of the exhibit.

### **Task 4 - Construct an Environment for a Driverless School Bus**

As part of the exhibit, the team must construct an environment for a WeDo driverless school bus to operate in. The environment may be constructed out of any materials to represent houses, streets, gardens, schoolyard, and school, etc. There should be elements in the environment that the team can use to demonstrate the workings of the driverless school bus.



### 3. Challenge Rules

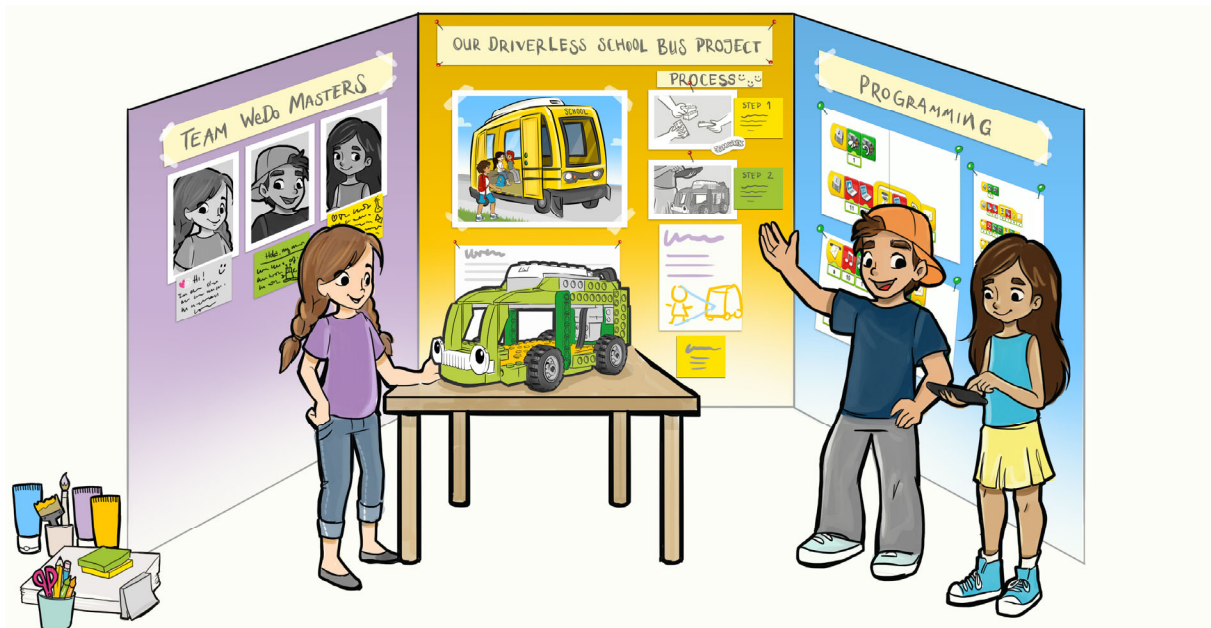
Each team has two or three team members and is assisted by a coach. The age of the team members is up to 10 years old.

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.

#### 1. Material

- 1.1. The size of the exhibit booth provided to teams will be 2m × 2m × 2m. (Each team will be provided with three (3) vertical display surfaces within the booth, each 2m × 2m or as close as possible).
- 1.2. All elements of a team's display must remain within the allotted 2m × 2m × 2m booth area. Team members may be outside this space during a presentation, however, unless requested by judges, cars/robots and other display elements must remain within the allotted area.
- 1.3. Teams will be provided with the option of using a table. The size of a table will be 120cm × 60cm (or as close as possible). Table sizes will be consistent across teams. Tables must be placed within the 2m × 2m floor space allocated to the team. Teams will be allocated four (4) chairs in their booth area.



### Regulations about the exhibit

- 1.4. There is no restriction on the balance between LEGO elements and other materials used in the exhibit.
- 1.5. The controllers, motors and sensors used to assemble the cars/robots must be from the LEGO Education WeDo 1.0/2.0 Core Sets. Any number and combination of controllers, motors, and sensors is allowed. Any LEGO branded non-electrical/non-digital elements can be used in the construction of the car/robot and the environment.
- 1.6. The car/robot can be controlled by any compatible device or with a remote controller built from WeDo 1.0/2.0 elements. The teams can use any software.
- 1.7. Cars/robots may be preassembled and programs may be pre-made.
- 1.8. Teams must decorate the booth with one or more of **their own** texts/sketches/drawings/photos or any other way to show their creative process and suggested solutions. The decoration of the booth must include the team name, introduce the team members, document the cars/robots constructed (e.g. with sketches/pictures of **their** building process and **their** programming attempts), and show the programs used in the cars/robots.



## 2. Presentation

- 2.1. All team displays must be completed and teams ready to present to judges and the general public by the allotted time. (Schedule and deadlines will be provided by the Local or National Organizer).
- 2.2. Teams must maintain a presence within the team's booth during competition hours in order to present to members of the general public and judges at any time. Teams will receive a warning of not less than 10 minutes prior to evaluation taking place.
- 2.3. Teams will be allocated approximately 10 minutes for evaluation: 5 minutes to explain and demonstrate their cars/robots, the remaining 5 minutes to respond to questions from the judges, e.g. about their understanding of their WeDo programming.
- 2.4. The official language for all presentations is the native language of the team members. Interpreters are allowed if judges do not speak the native language of the team members.
- 2.5. The Local or National Organizers decide how the achievement by the exhibiting teams could be rewarded e.g. with a diploma for each team or with special awards for some teams based on criteria given by Local or National Organizers.

## 4. Challenge Evaluation

Each team must prepare a 5-minute presentation in front of judges. The presentation must include:

- For each of the challenge tasks 1 and 2 show the video of the team's solution.
- For each of the challenge tasks 1 and 2 explain the program that controls the WeDo mobile robot on the video.
- Describe the equipment and decoration of the inside of the driverless bus based the findings in task 3.
- Demonstrate the driverless school bus in the exhibit and explain the mechanics/programs of the bus.

After the presentation, each team must be prepared to participate in a 5-minute dialog with the judges, answering questions from judges in relation to their presentation, but also questions such as:

- What part of the team's results is the team most proud of?
- If the team had more time to work on the exhibit, which part of the exhibit would the team try to improve and how could the improvement be made?

For the team, the overall purpose of the evaluation is to demonstrate that **they** understand what **they** have been doing.





For the judges, the purpose is to help the team reflect on their process and product, and to provide feedback through their questions to the team on the strong and weak points in their process and product.

For the judges, the purpose is also to ensure that **all team members have had a fun, age appropriate learning experience where they have tried things out themselves**, and perhaps got inspired by others (as facilitated by a coach).

## WRO 2019 – Open Category – WeDo

The following table can be used to evaluate the teams. For each entry in the table, a smiley from a four-level smiley scale is chosen as the evaluation of the task in question.

A sad smiley is only ticked off when the task in question is not present in the exhibit.

Tasks				
Autonomous emergency braking:				
- The team has created a video that shows a WeDo car performing emergency brake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- The team understands the program performing emergency brake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Automatic parking:				
- The team has created a video that shows a WeDo car performing automatic parking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- The team understands the program performing automatic parking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inside a Driverless school bus:				
- The exhibit describes the inside of a driverless school bus by means of text/sketches/drawings/models	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driverless school bus:				
- The bus is mechanical stabile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driverless school bus:				
- The bus's functions are successfully demonstrated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driverless school bus:				
- The bus's interaction with environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Booth decoration, photos, drawings, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Presentation and dialog with judges showed that <b>the team have done things themselves</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>In total</b>				