



Plesiosaurus



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Plesiosaurus

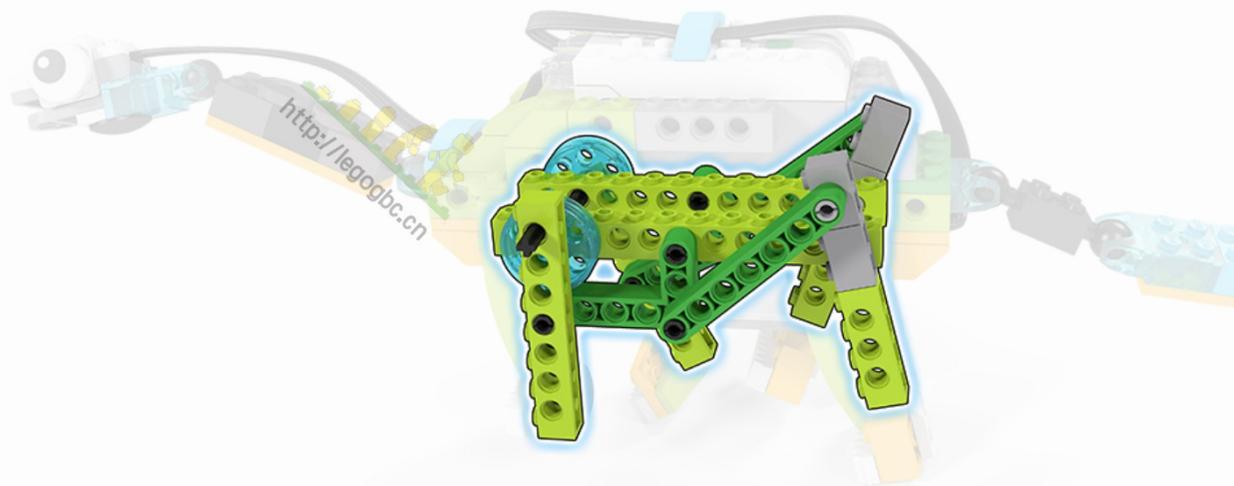




Let`s remind! Sauropod



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Place parts of the robot on the right places





Let`s remind! Sauropod



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To which animal group do Sauropods belong?



Herbivores

Predators

Omnivorous



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New day at the Robots` factory



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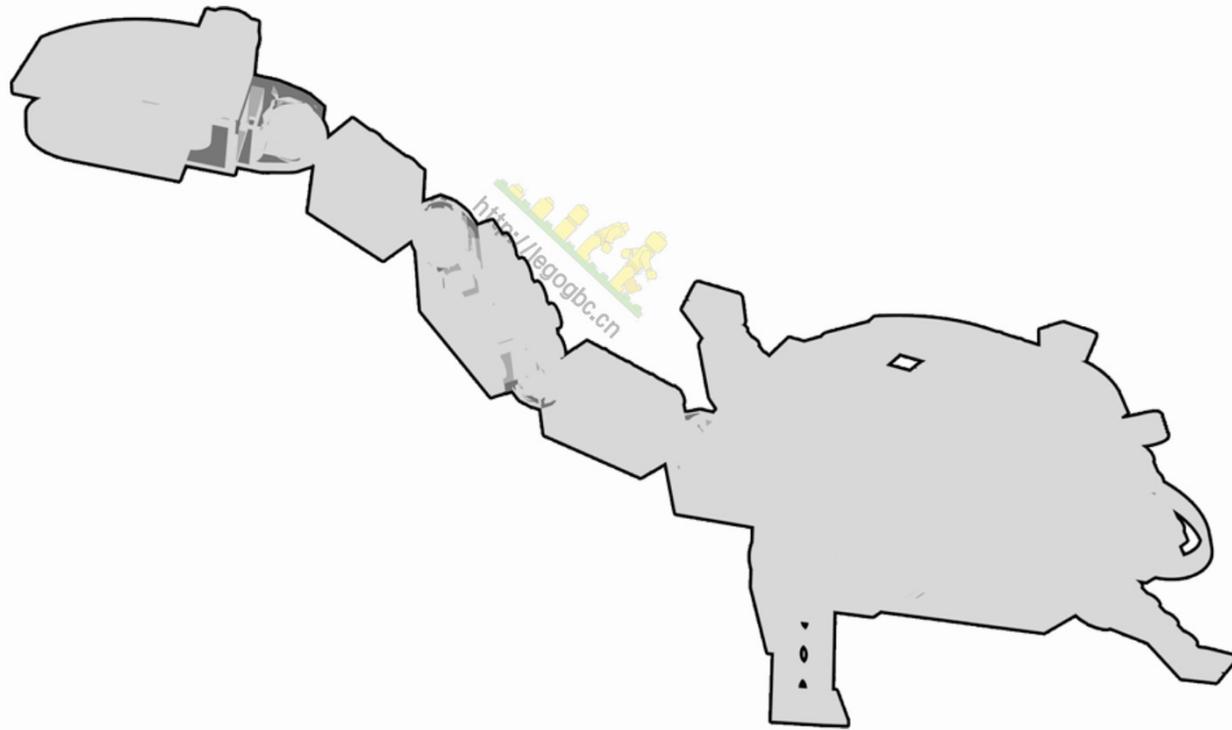


Dino Park



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Today we continue to create a modern Dino Park. We must develop a robot for the exposition of life in the ocean of the Jurassic period by the Mesozoic.



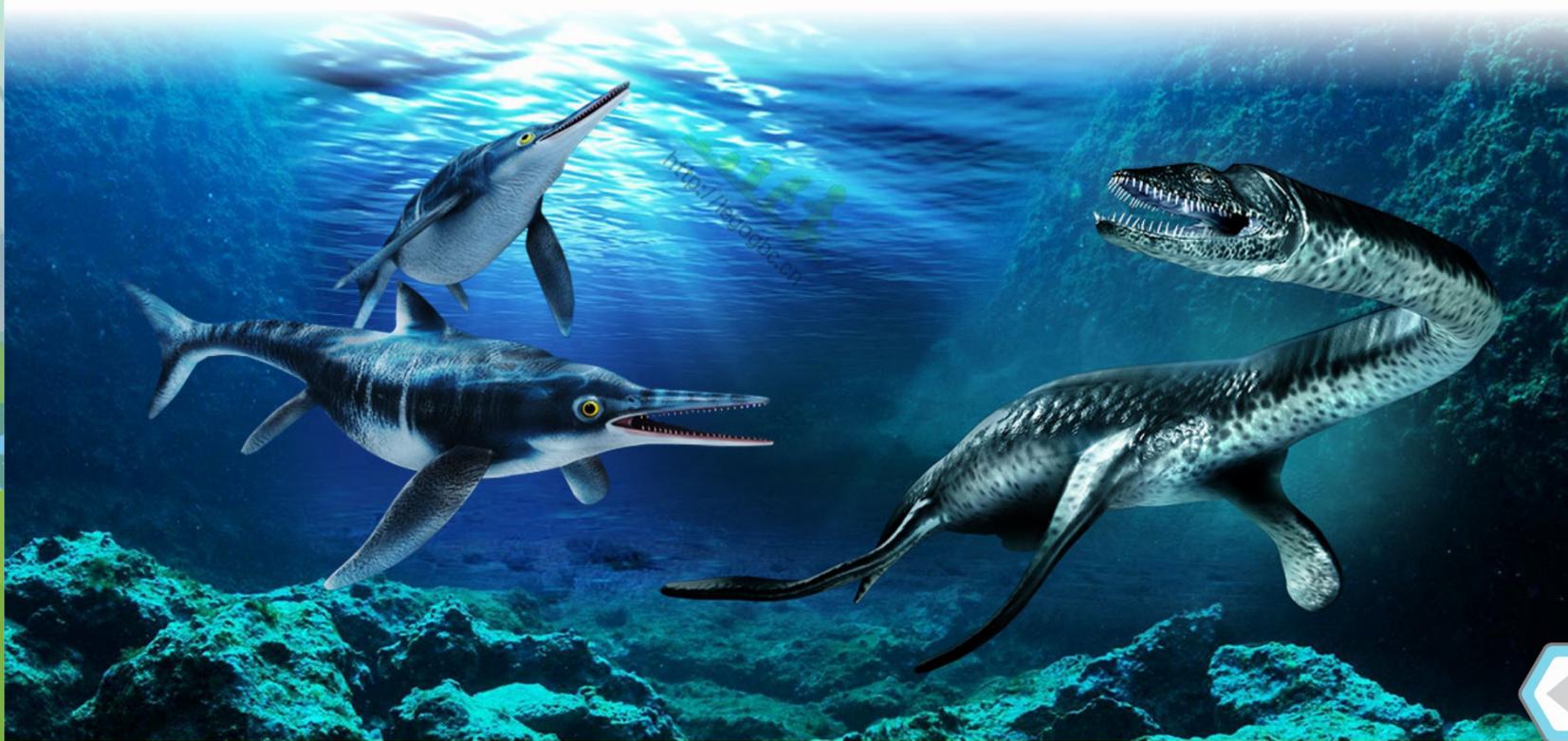


Dino Park



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In the Jurassic period, the dinosaurs dominated on the land, while Plesiosaurs dominated in the warm seas and oceans. The bivalve mollusks developed in shallow water, and the coral reefs became almost as we know them now.



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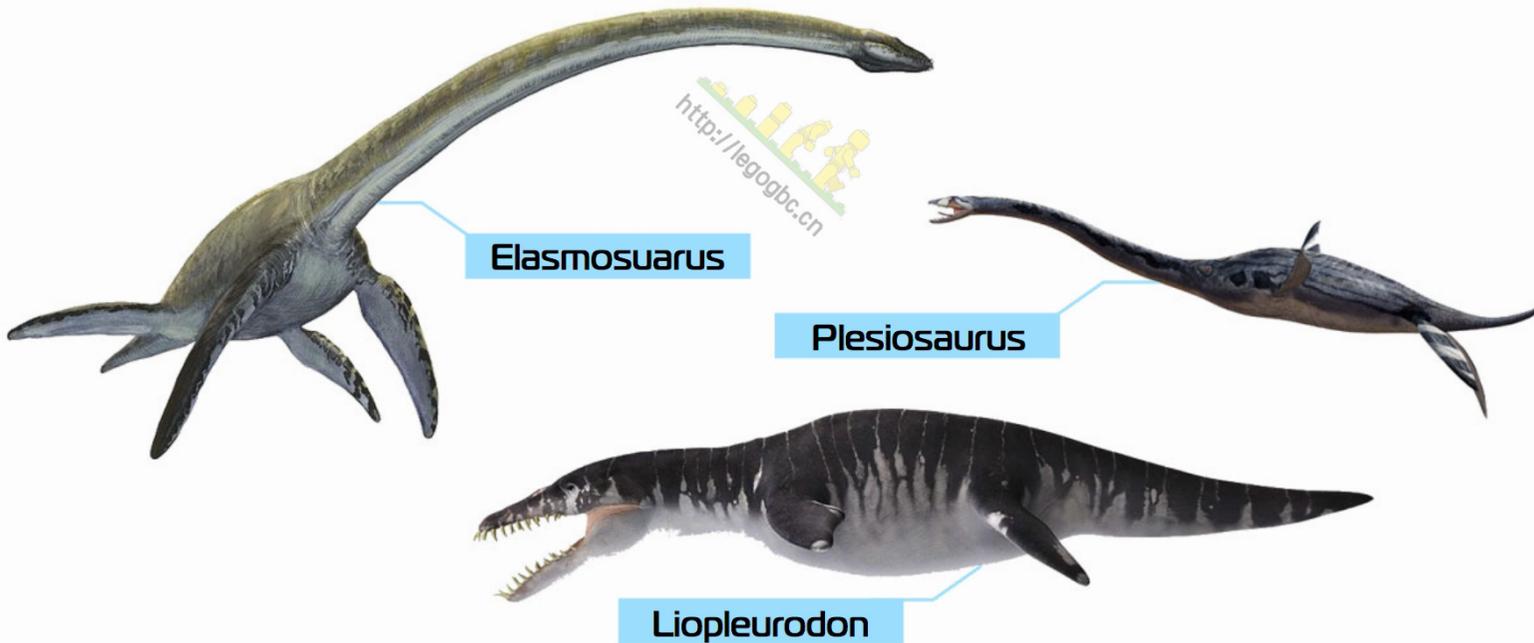


Plesiosaurus



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These predator reptiles lived more than 200 million years ago. They had two kinds of body. Some were with long necks and small heads, and others with short necks and huge heads, with jaws full of sharp teeth.





Plesiosaurus



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Plesiosaurus ate the fish, mollusks and squid. At the same time sharks also lived. But Plesiosaurus were the dominant predator of the ancient seas.



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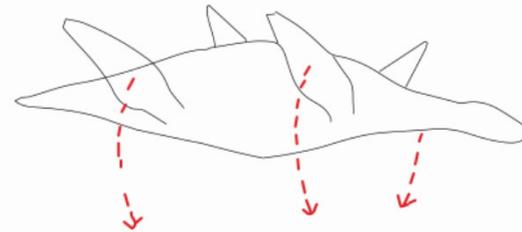
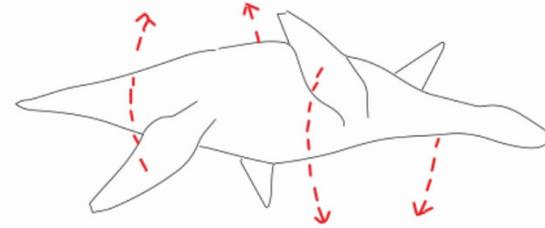
Way of movement



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For swimming Plesiosaurus used four flippers. Investigating the skeletons of Plesiosaurus and modeling their movement made it possible to find out exactly how they swam. It is believed that two types of flippers movement could be used.

- With slow moving, front and rear flippers moved in opposite directions.
- If it was necessary to make a quick jerk, the Plesiosaurus pushed itself straight ahead with four flippers.



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Discussion of the task



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<http://teogobc.cn>

What do you know about the predators of the ancient seas? Who was the biggest?

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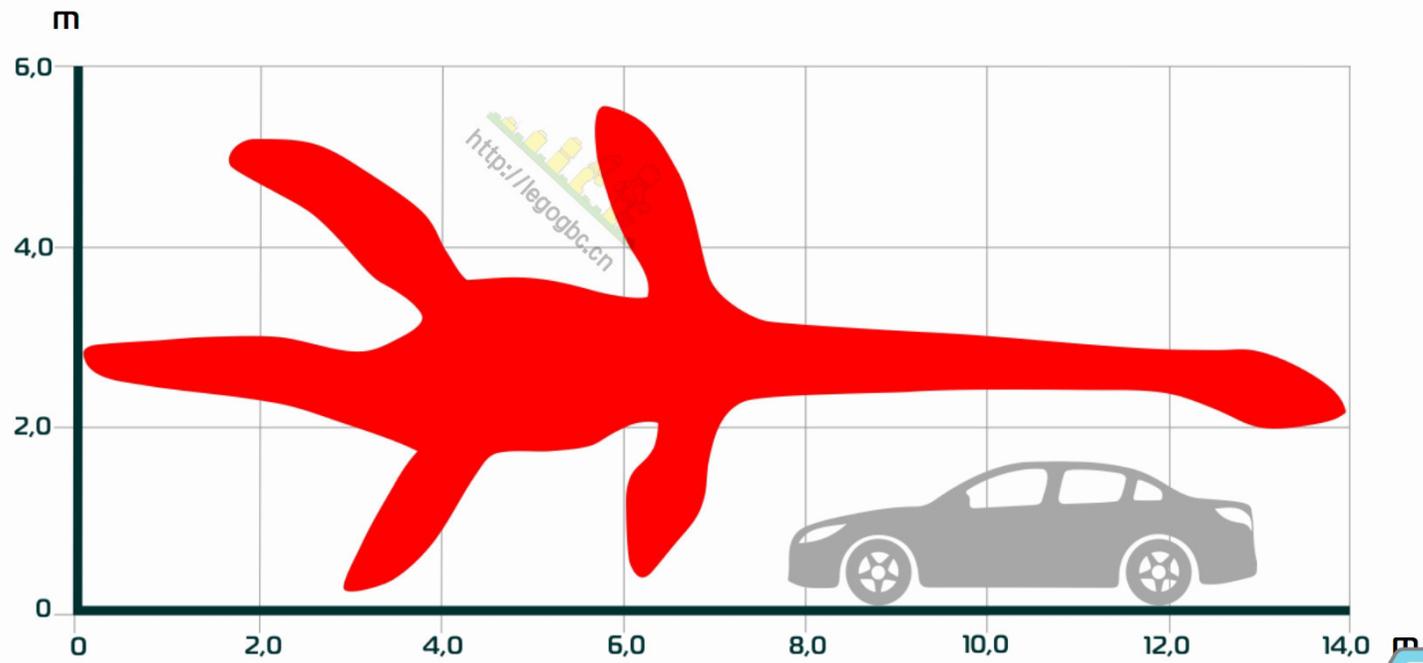


Plesiosaurus



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The largest found Plesiosaurus (Elasmosaurus) was 14 meters long, like three cars stacked one after the other.





Plesiosaurus



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The Plesiosaurus had four powerful flippers, thanks to which they could "fly" in the water. Similarly, modern penguins and sea turtles swim under water.



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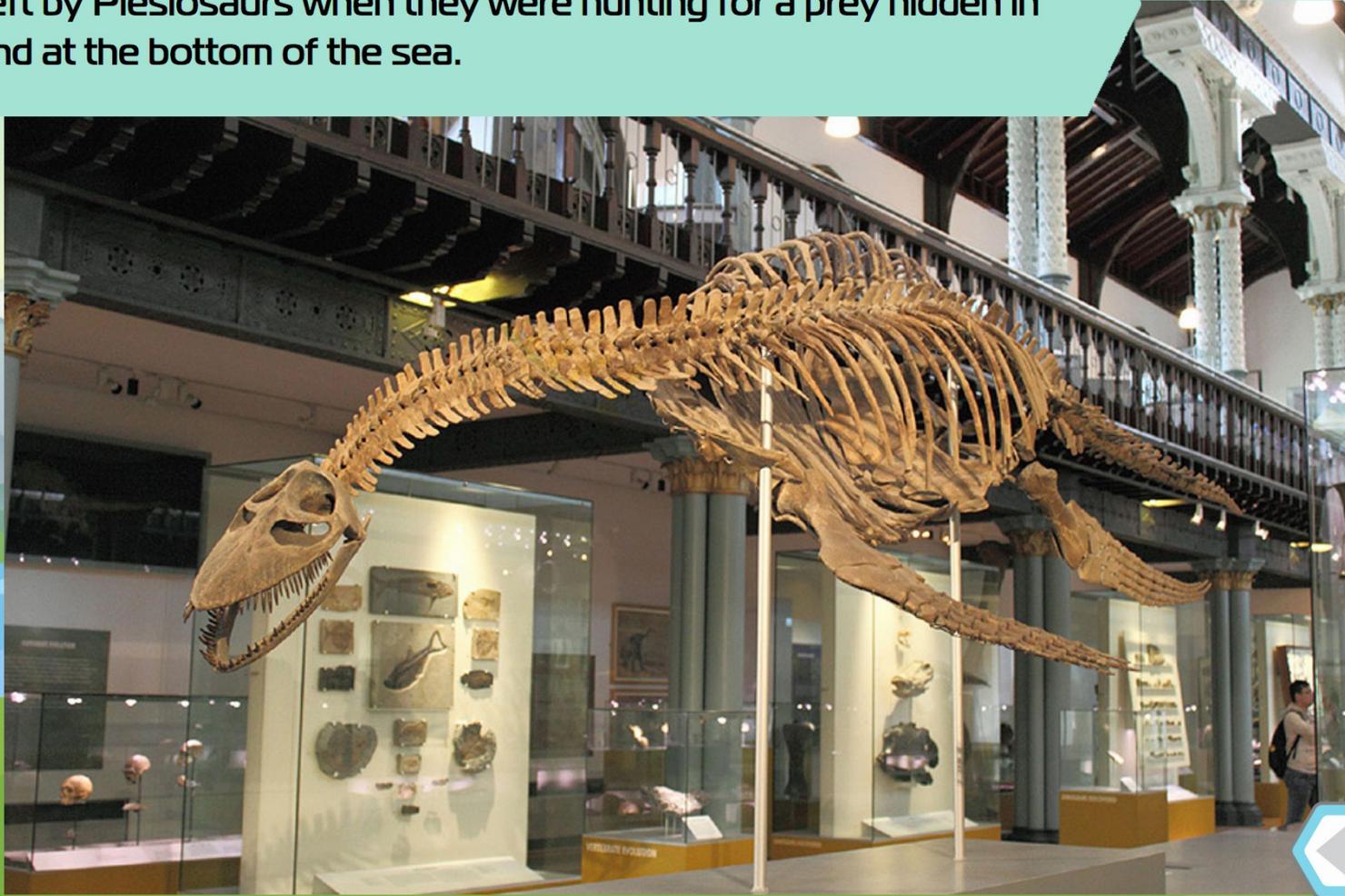


Plesiosaurus



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On the fossil seafloor, long furrows were found. It is believed that they were left by Plesiosaurs when they were hunting for a prey hidden in the sand at the bottom of the sea.



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Plesiosaurus and Ichthyosaurus



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These two creatures are often confused, although they are very different. Pay attention! Ichthyosaurs are more like modern dolphins.



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Predator-X



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The remains of the largest of the open predators were found in Spitsbergen. It was nicknamed Predator-X. It had a length of 13 meters, and the force of the jaw exceeded the strength of the bite of the Tyrannosaur 4 times.



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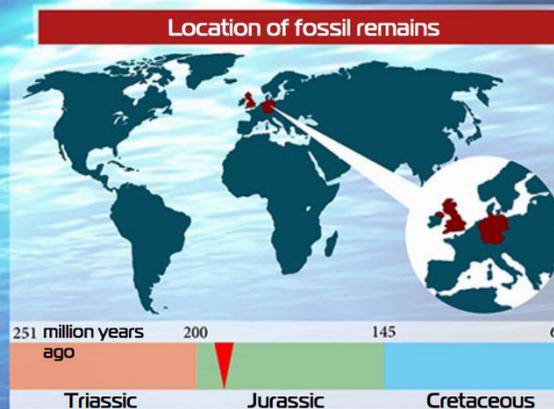


Plesiosaurus



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Fossils of Plesiosaurus were found in Europe in the territory of Britain and Germany. It is believed that they hunted for fish, and could themselves become the prey to large predators.



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Discussion



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<http://hegogbc.cn>

What do you think, why some Plesiosaurus had long necks and small heads, and others - short necks and huge heads?

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Dino Park



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Dino Park will not be able fully present the prehistoric world, if there are no dinosaur`s neighbors living in the oceans of that time. So today, we will build Plesiosaurus.



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TASK



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Task

- create a robot for the exposition about life in the seas of the Jurassic period

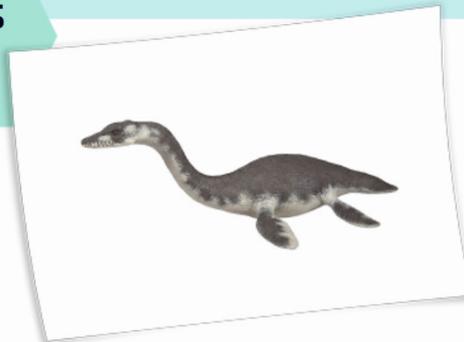


Requirements

- should simulate the movement of flippers and have long neck
- should be able to change the speed and position of the neck



Plesiosaurus's appearance



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TASK



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Task

- create a robot for the exposition about life in the seas of the Jurassic period

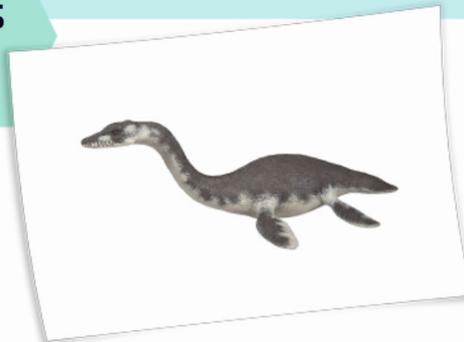


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Plesiosaurus's appearance



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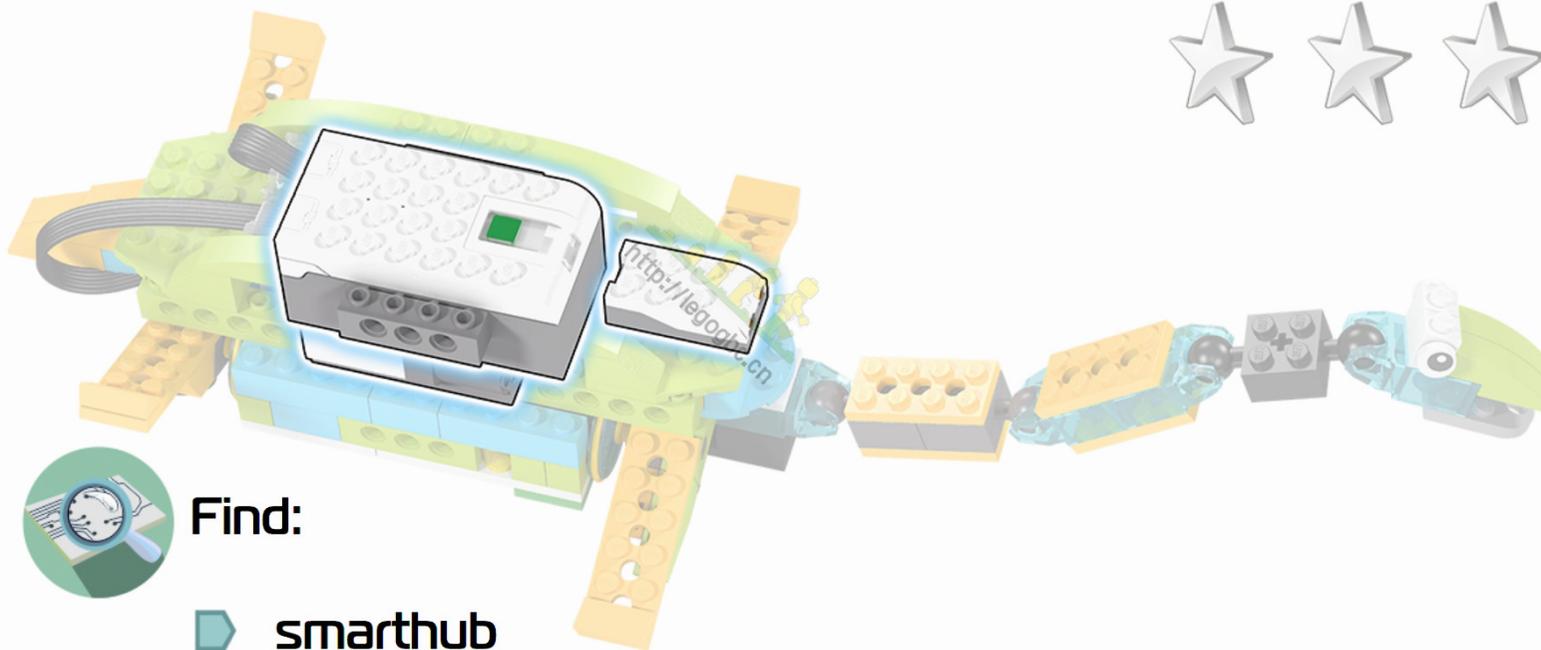


Design features



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Plesiosaurus uses a motor to drive all four flippers. Motion sensor is placed that the robot "see" its own neck.



Find:

- ▶ smarthub
- ▶ motor
- ▶ motion sensor

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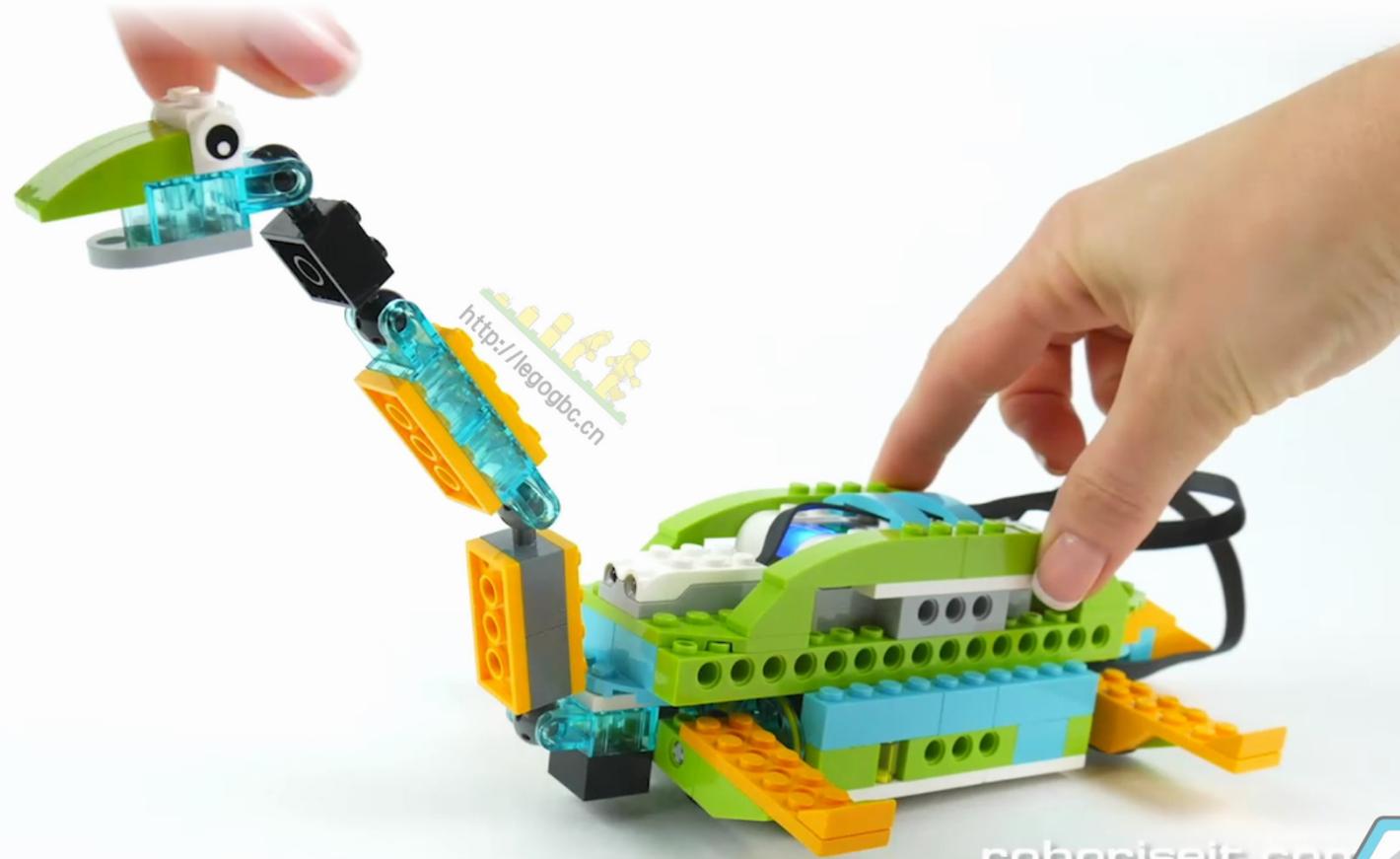


Design features



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The motion sensor measures the distance to the robot neck. Therefore, depending on its position, it is possible to program various actions of the robot.



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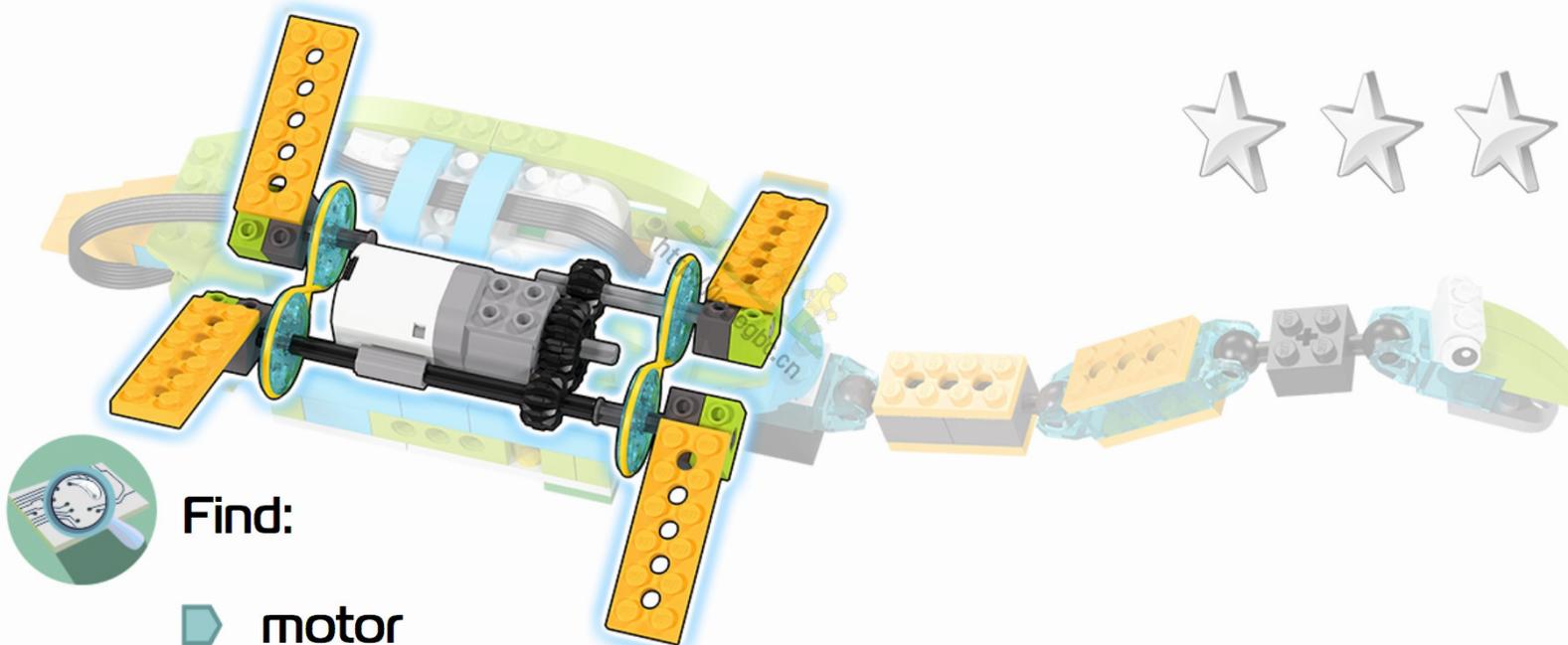


Design features



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In order for the left and right robot flippers move synchronously down and up, the rubbers in the belt drive is crossed.



Find:

- motor
- axis, going to the front and rear flippers
- front and rear pulleys with belt drives

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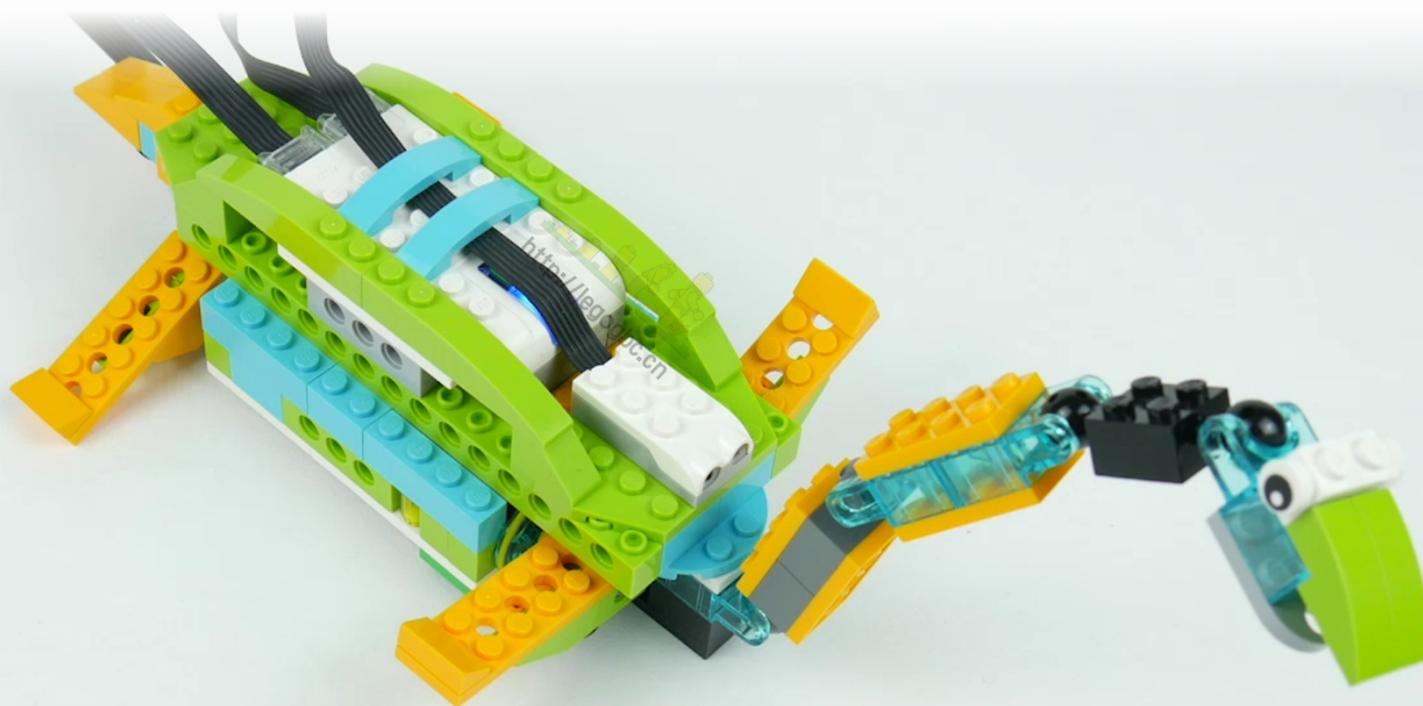


Design features



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Pay attention! The Plesiosaurus made their flippers movement in pairs. When the front flippers move down the back raised, and vice versa.



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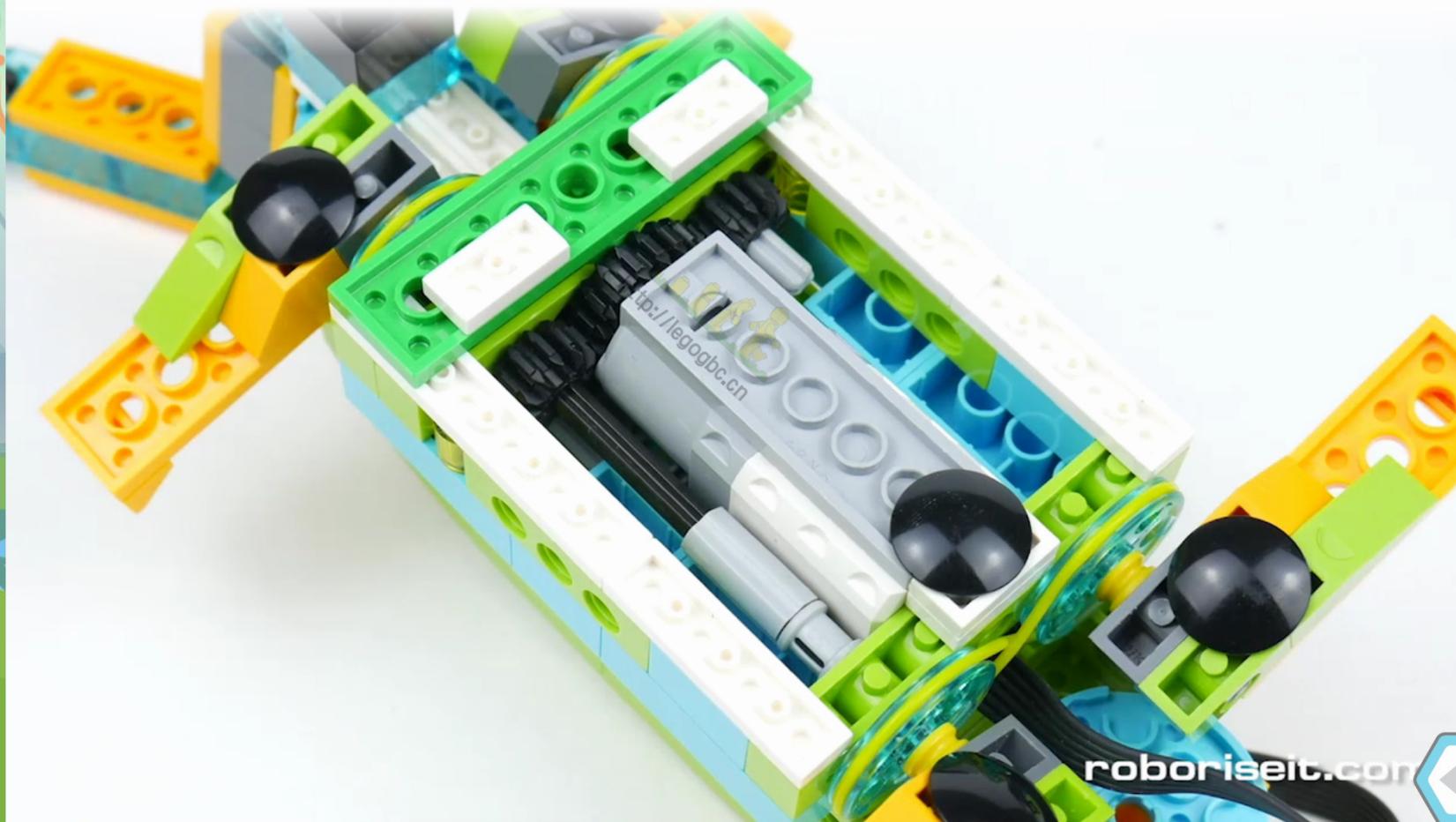


Design features



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In the drive of the flippers, direct gear and belt drives are used.



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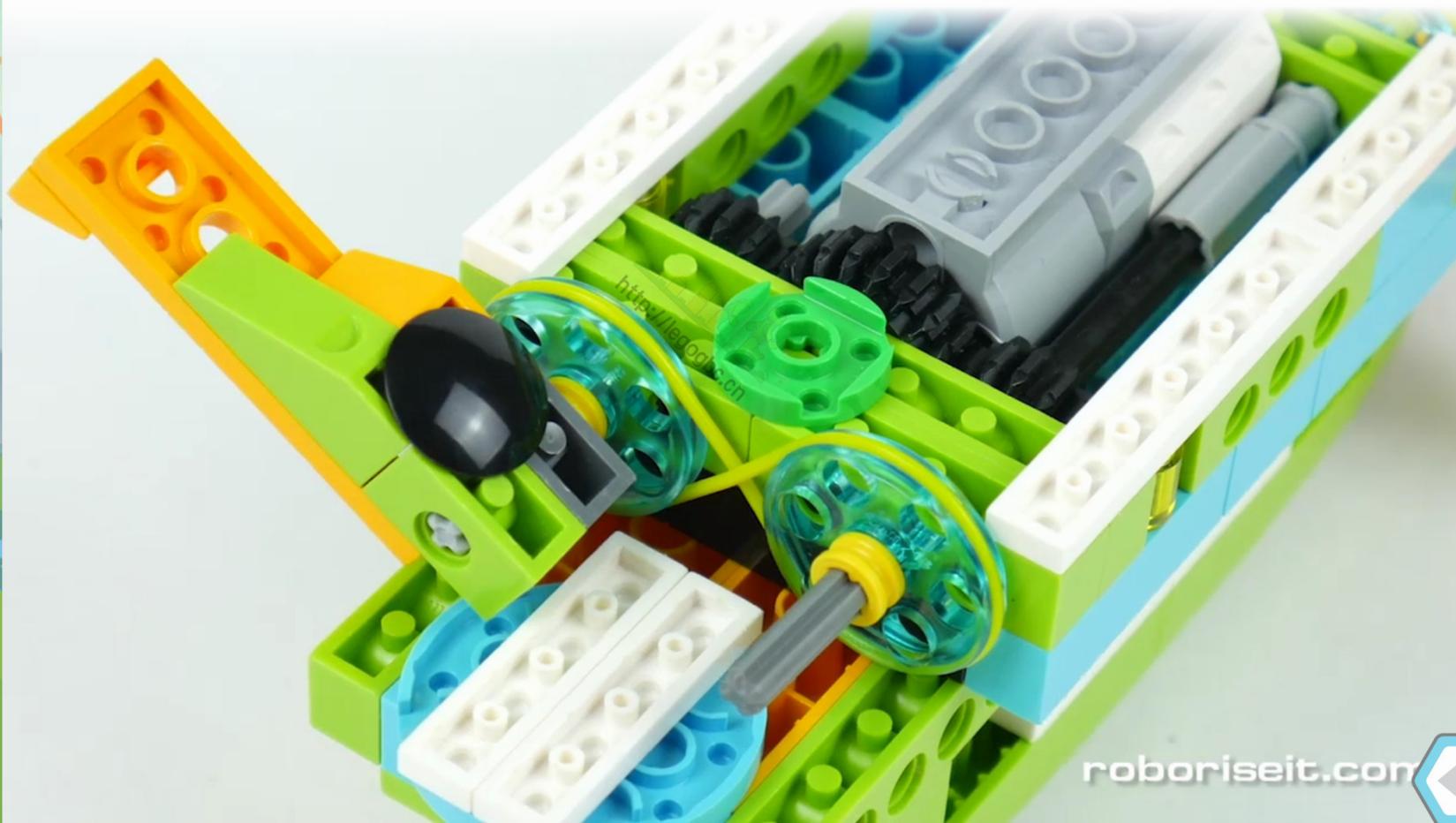


Design features



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Cross-placement of rubbers in belt drives is used. This synchronizes the movement of flippers.





Build the robot!



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<http://legogbc.cn>

Plesiosaurus



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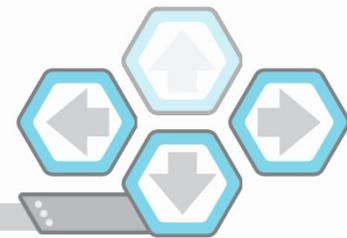
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1x 2x

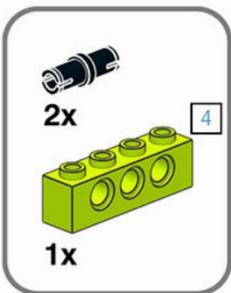
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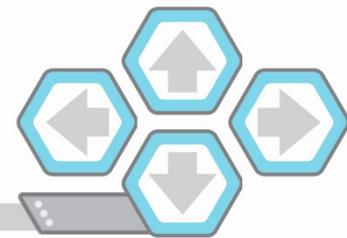
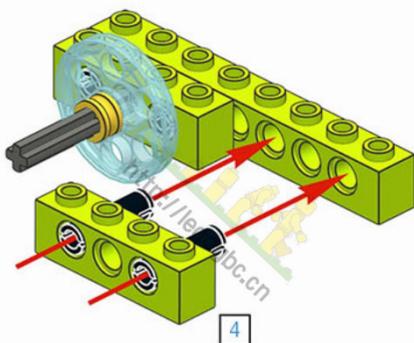




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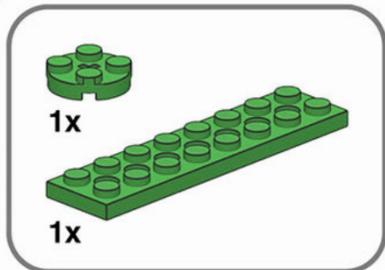


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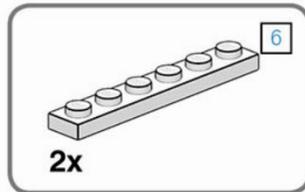
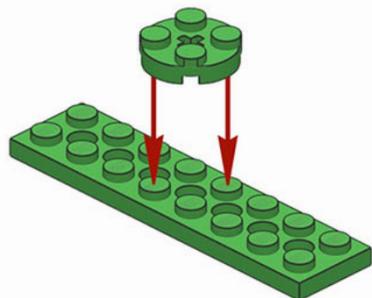




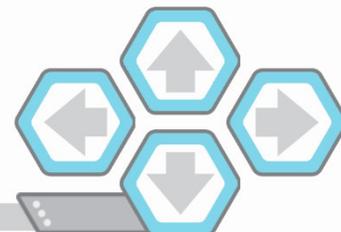
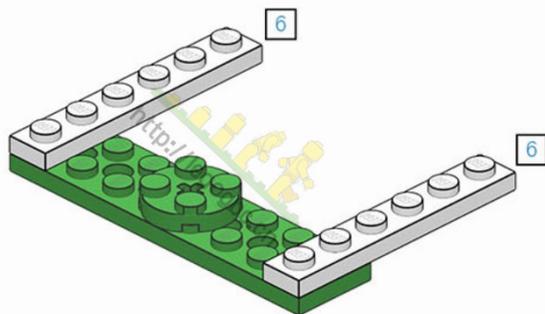
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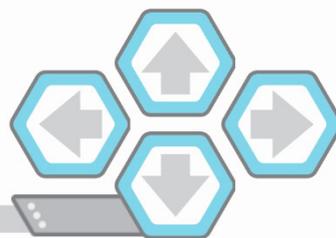
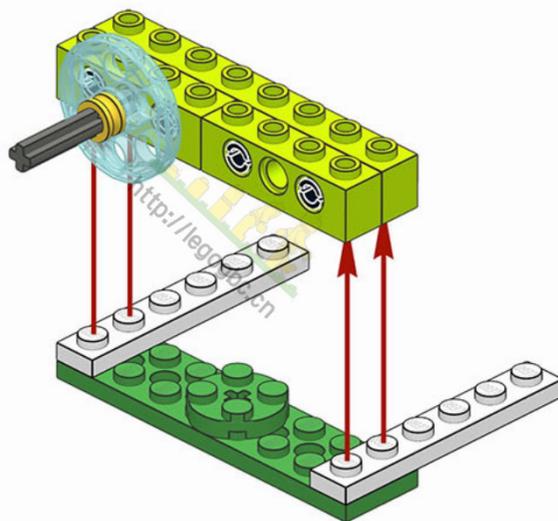
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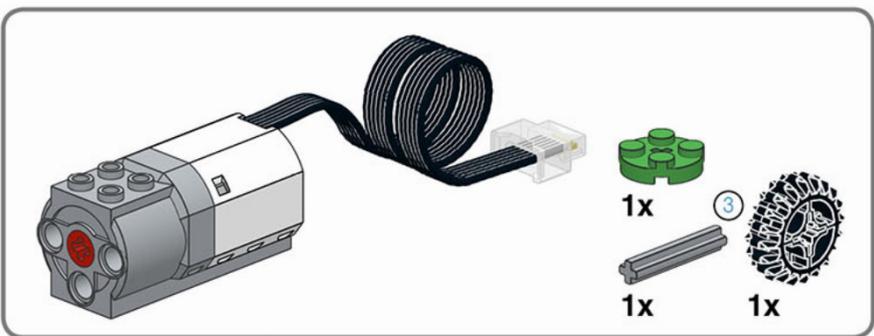
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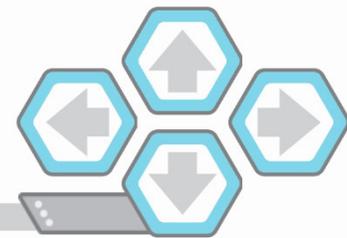
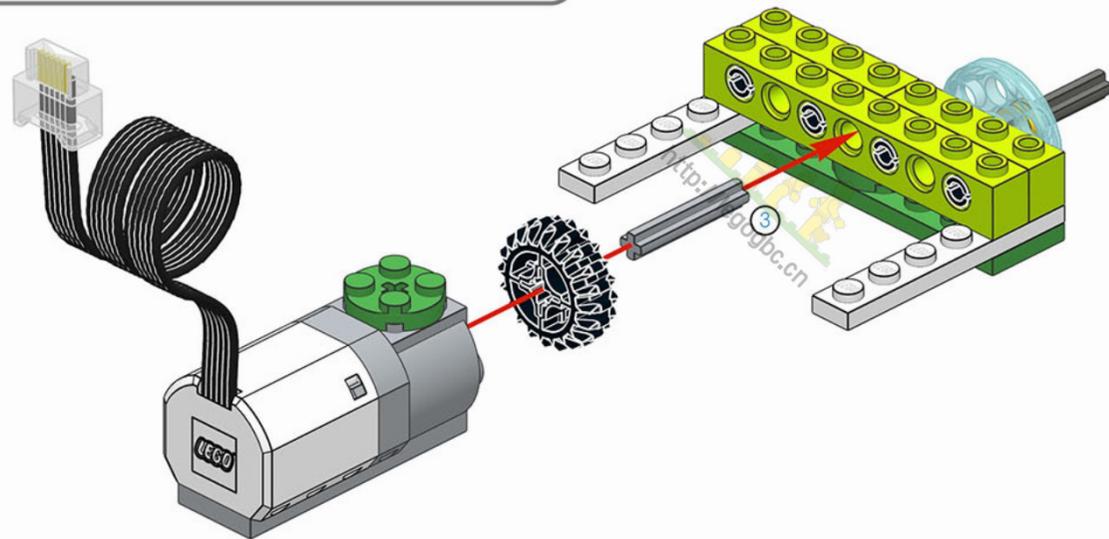




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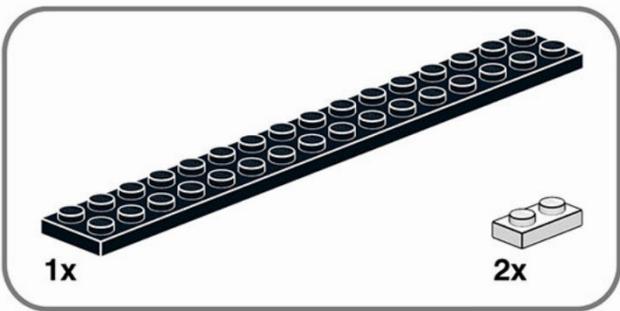


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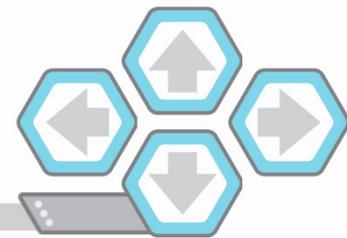
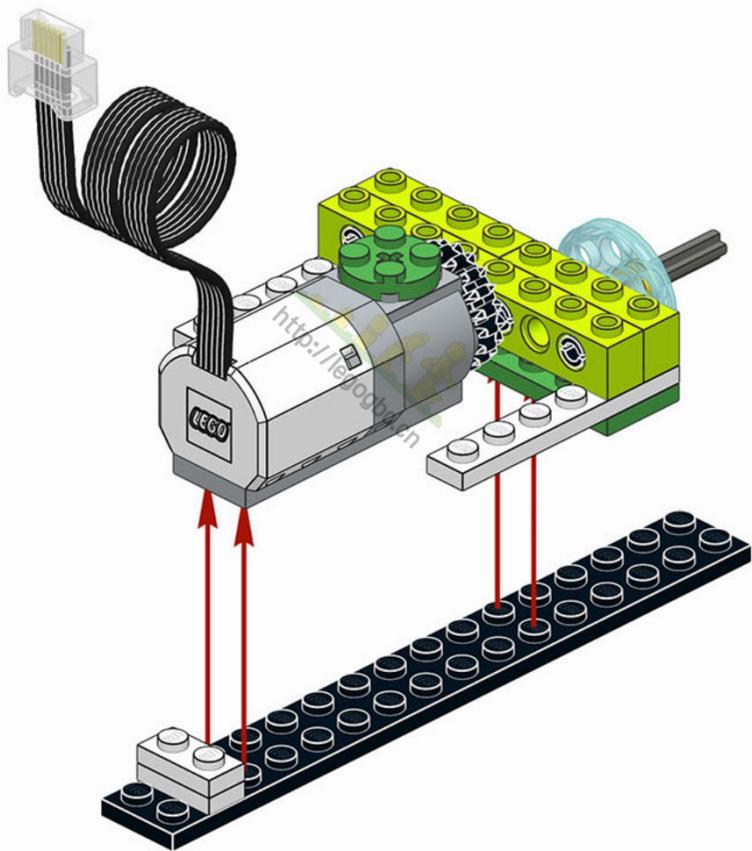




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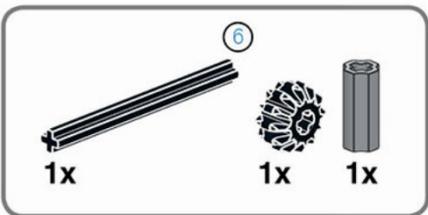


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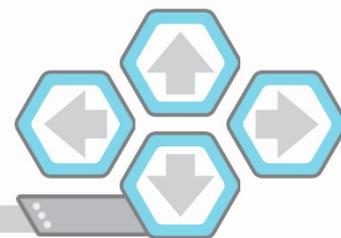
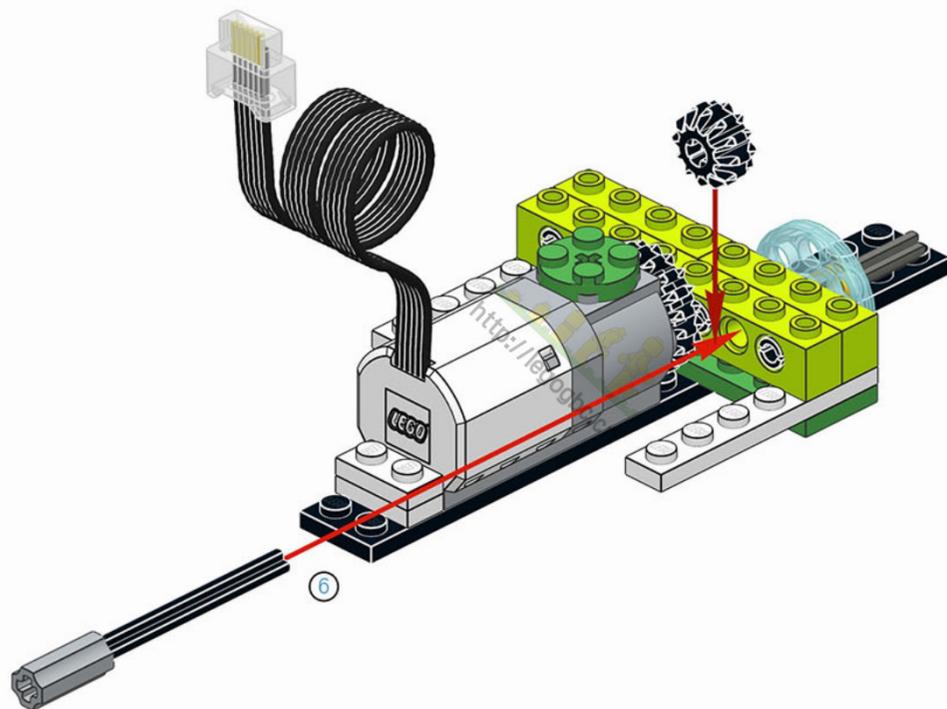




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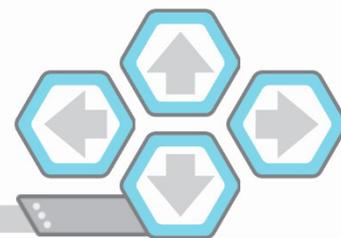
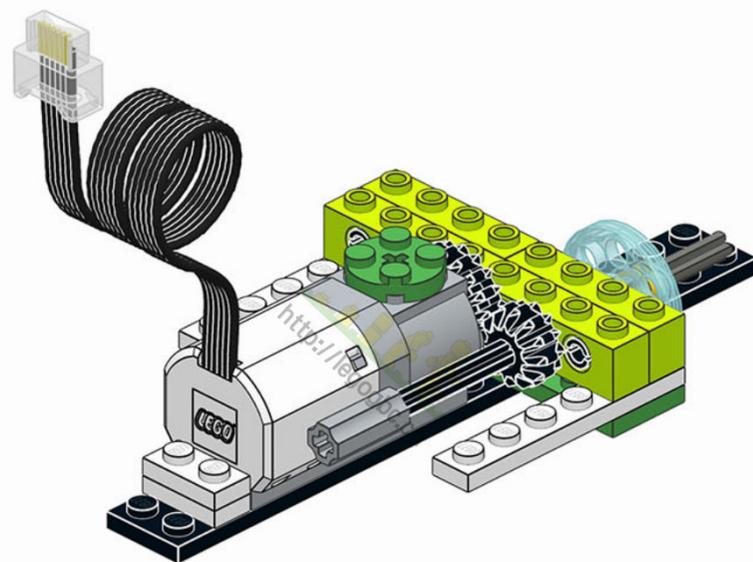
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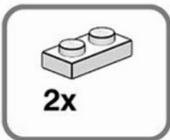
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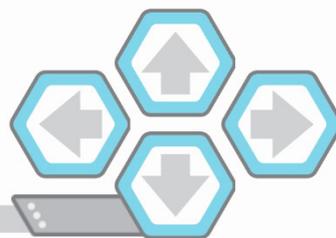
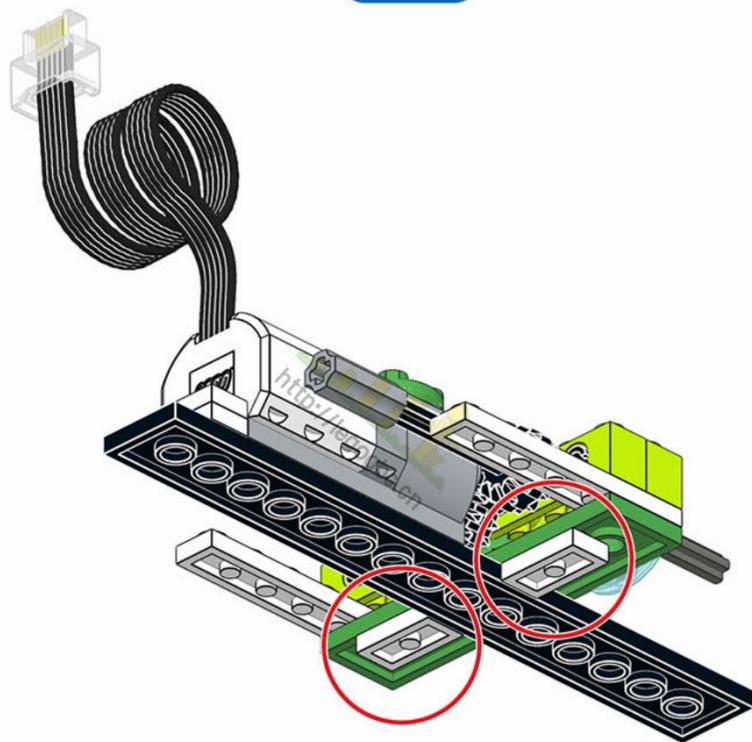




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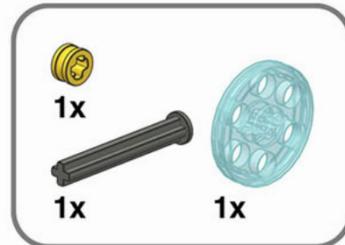
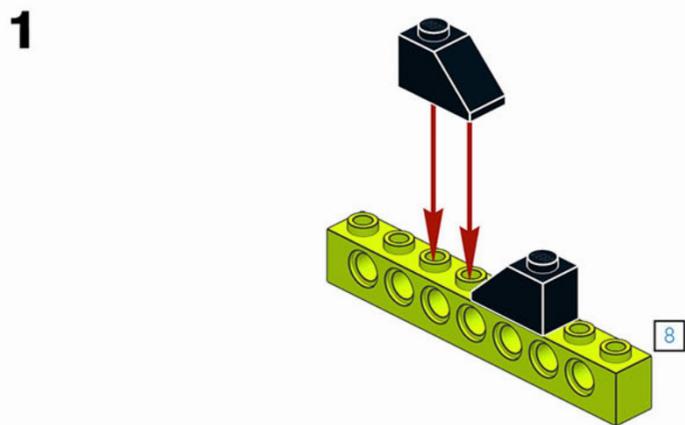
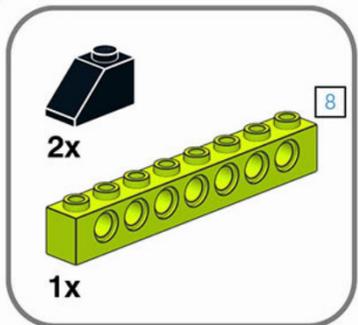


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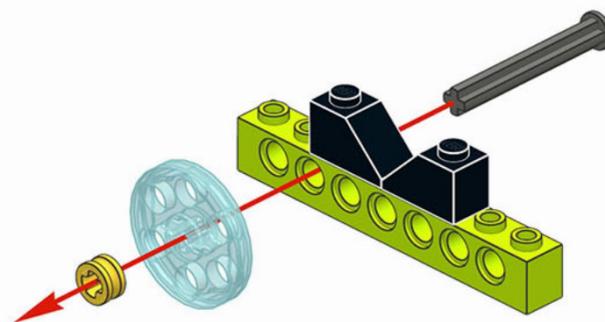




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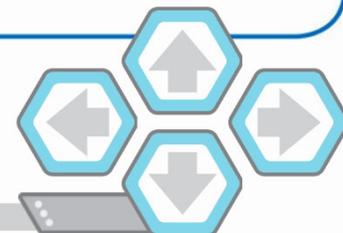


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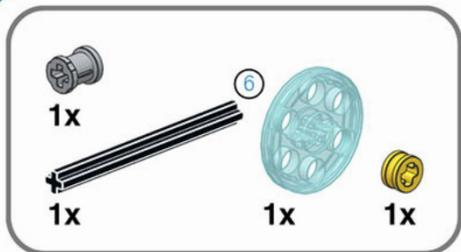
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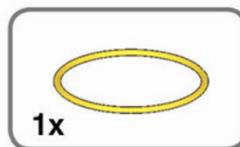
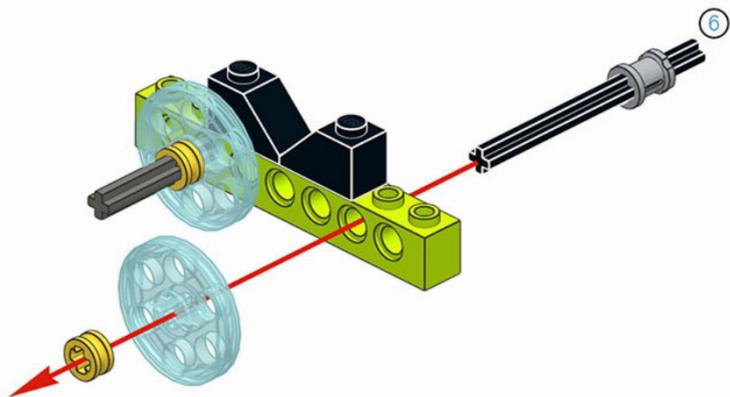




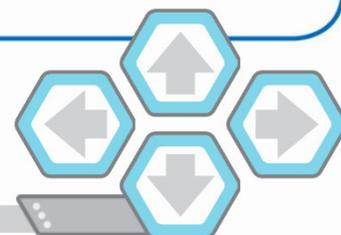
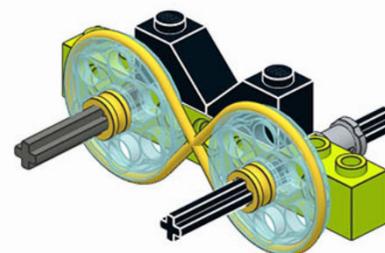
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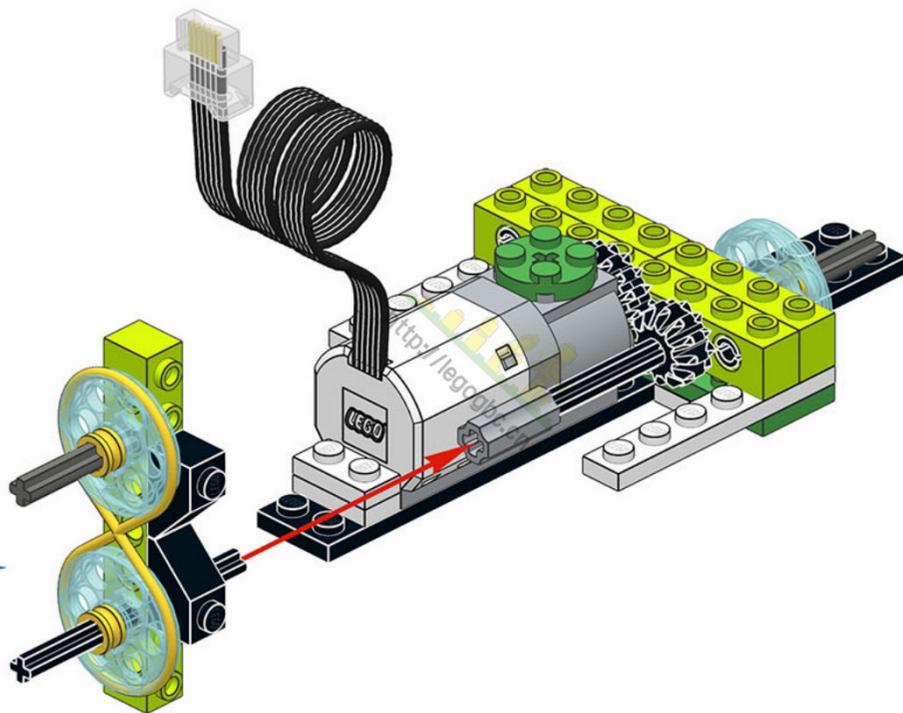




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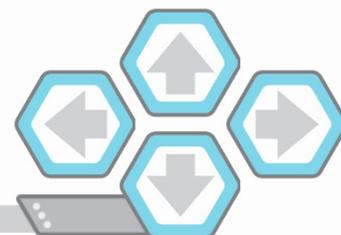
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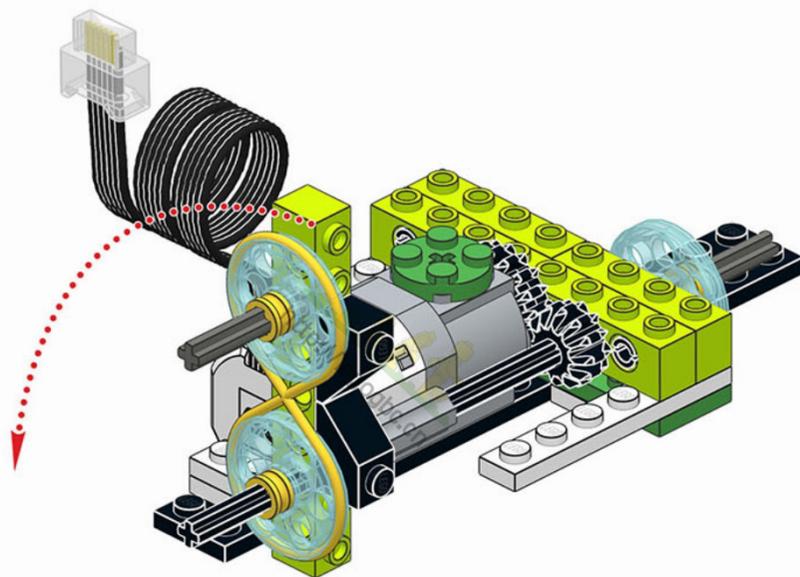
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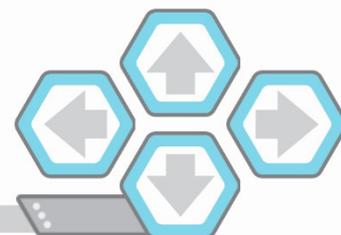
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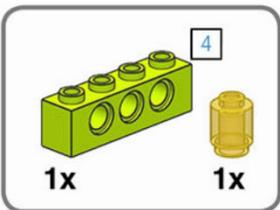
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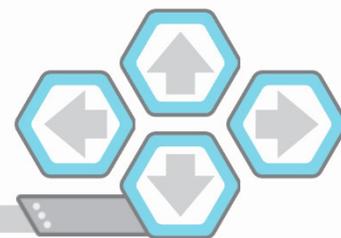
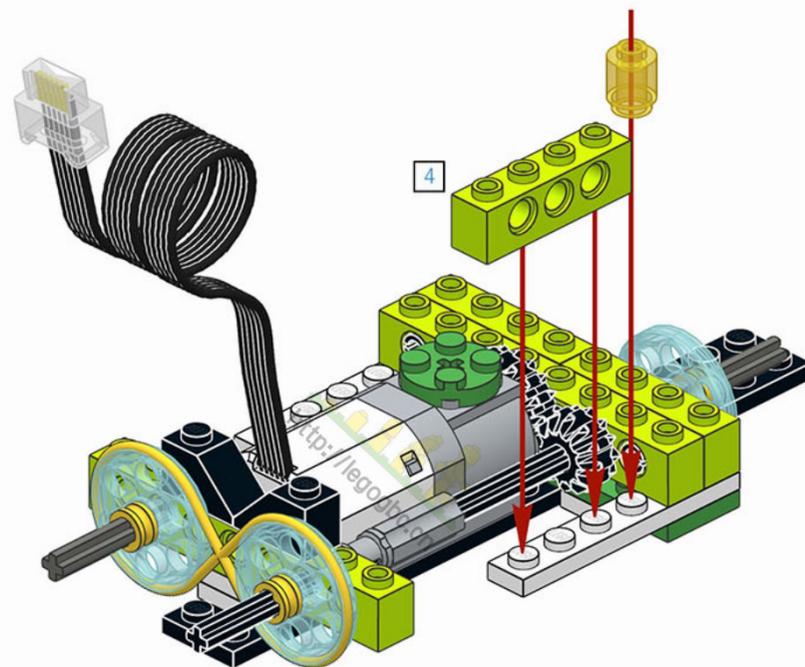




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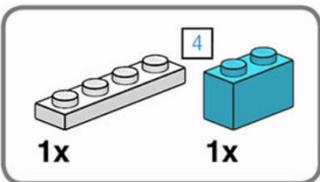


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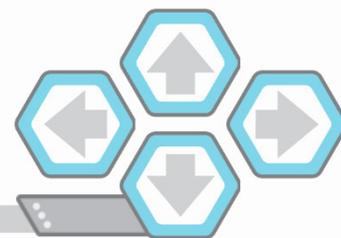
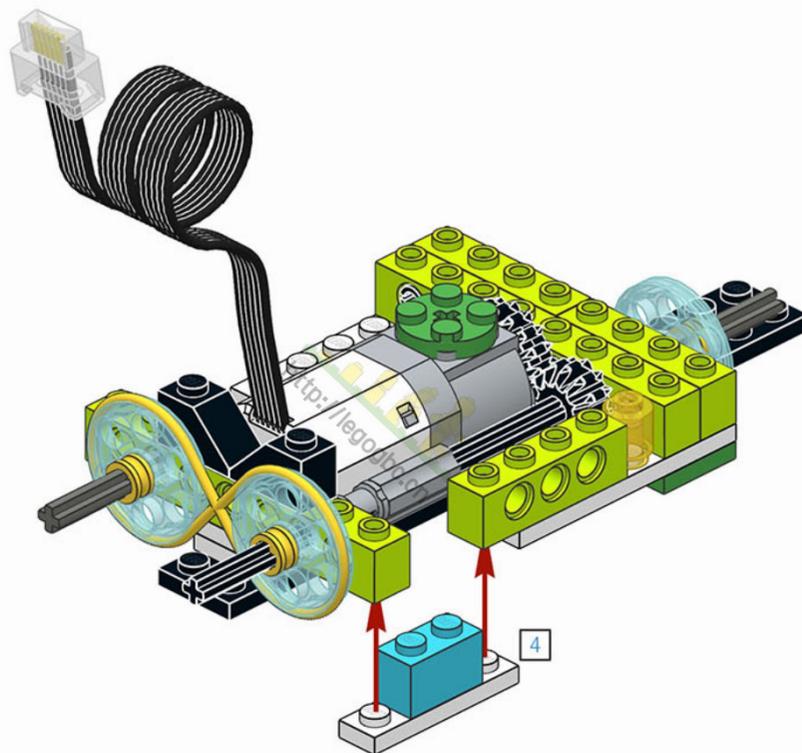




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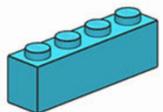


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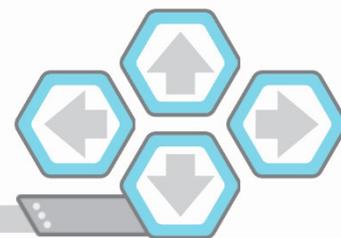
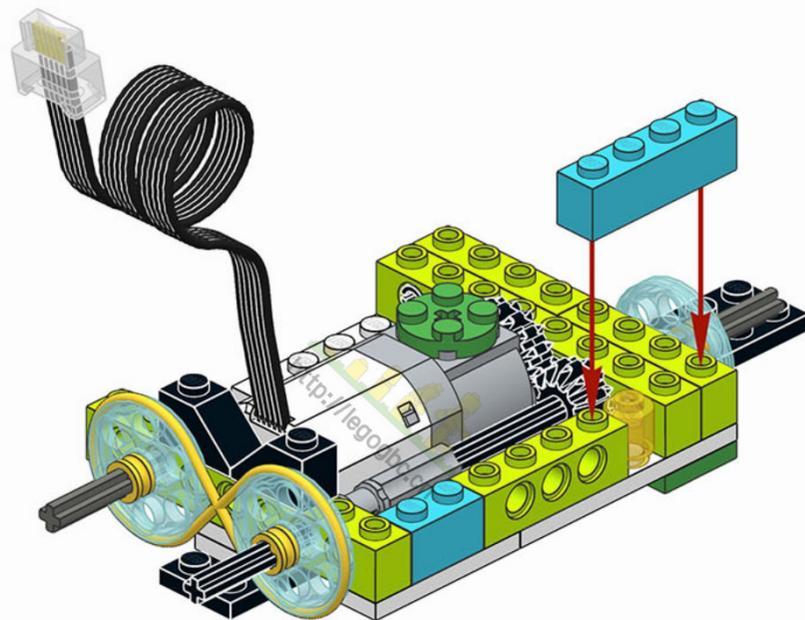


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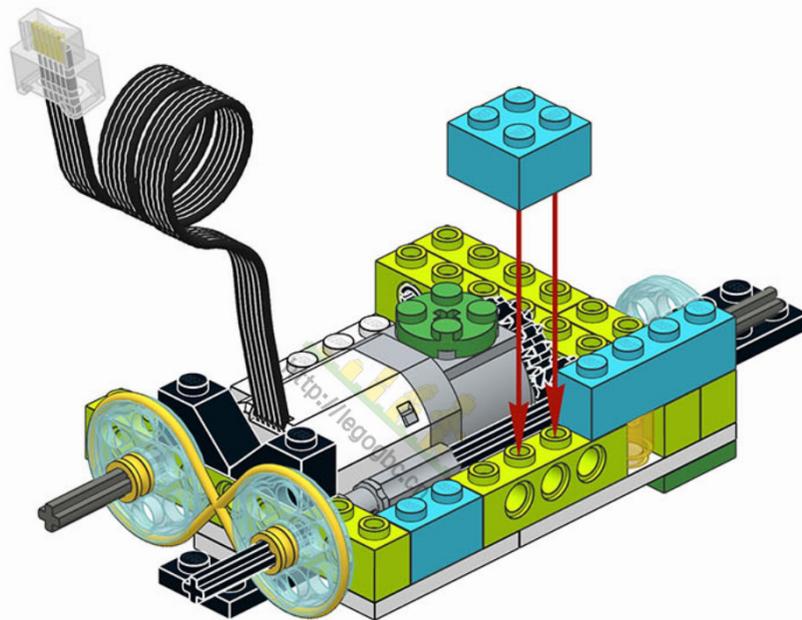


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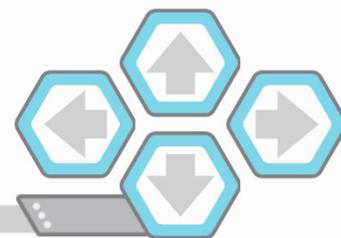
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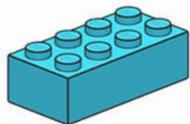


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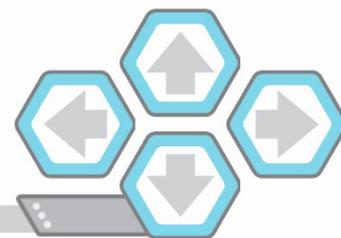
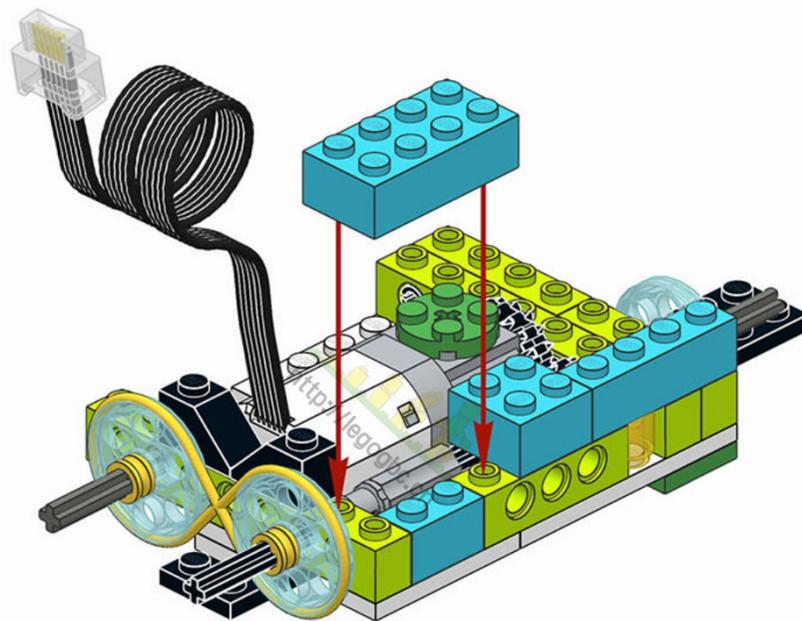


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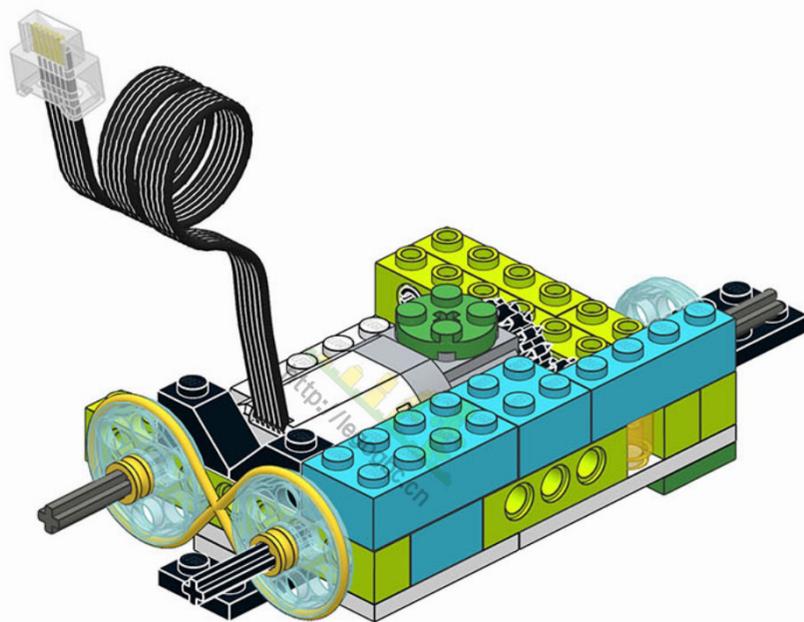
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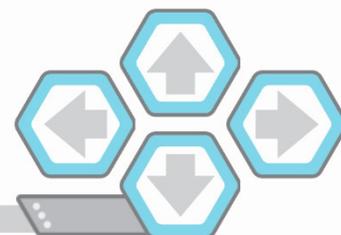
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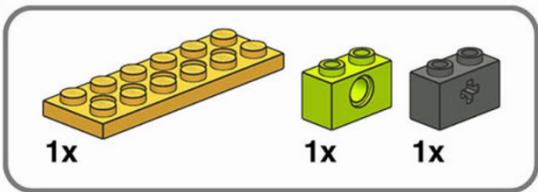
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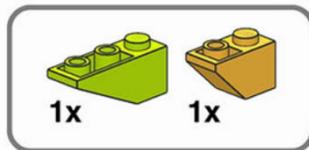
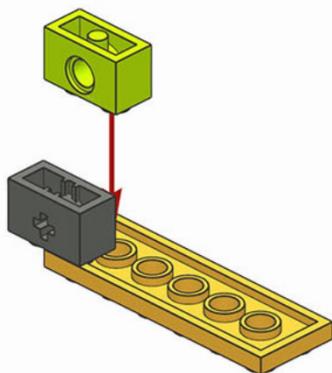




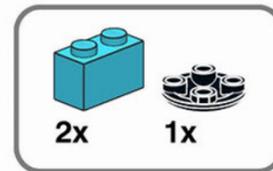
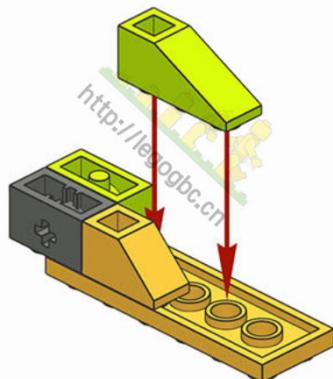
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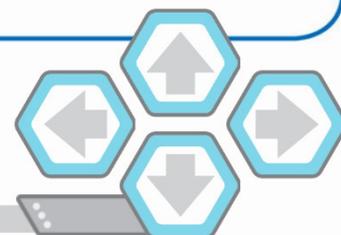
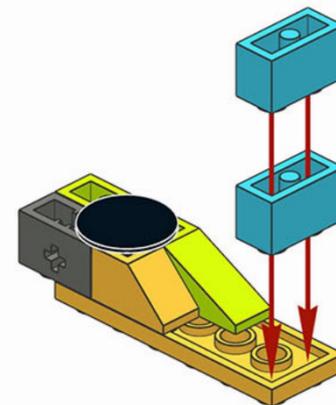
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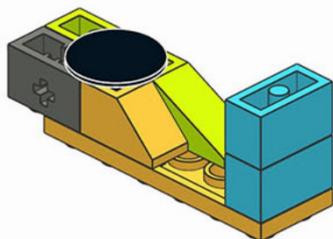
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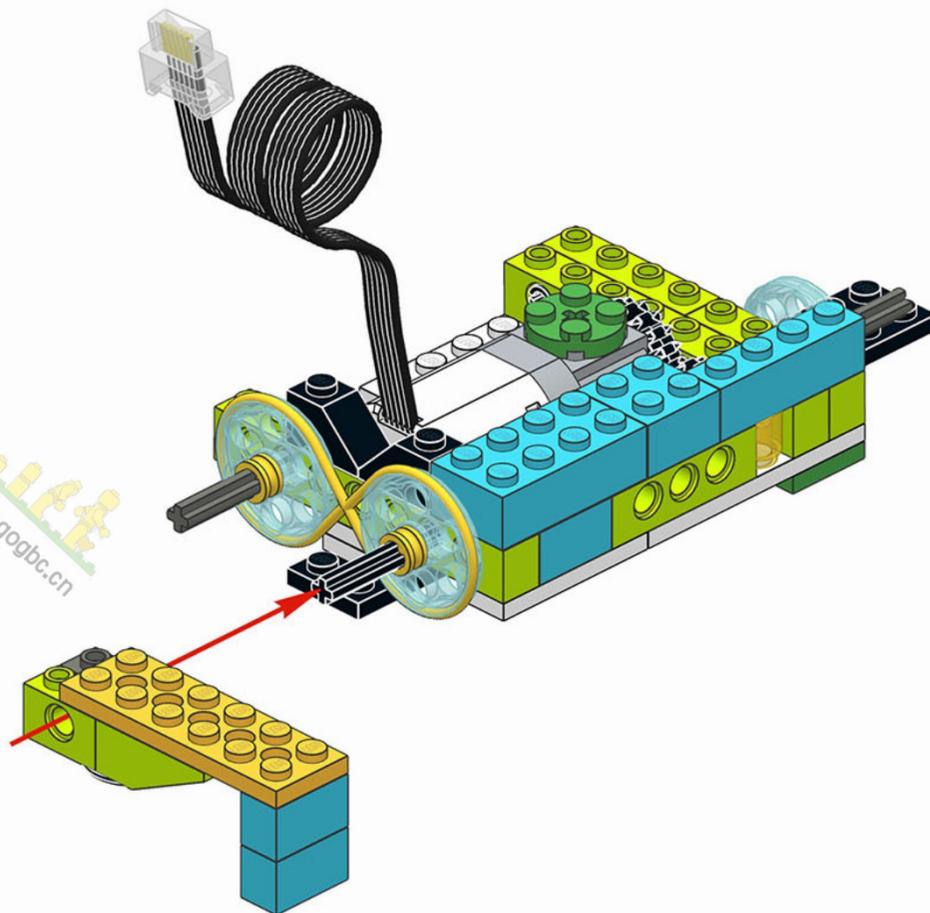


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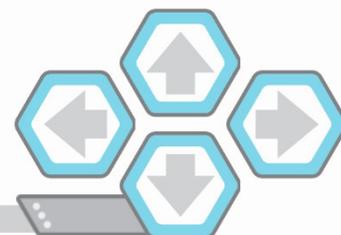
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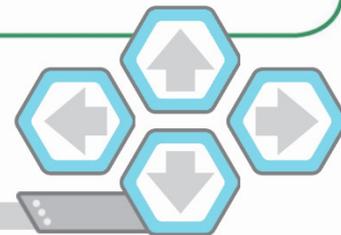
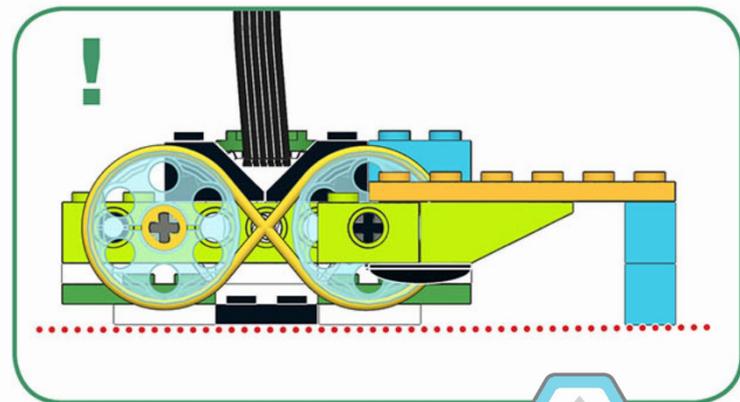
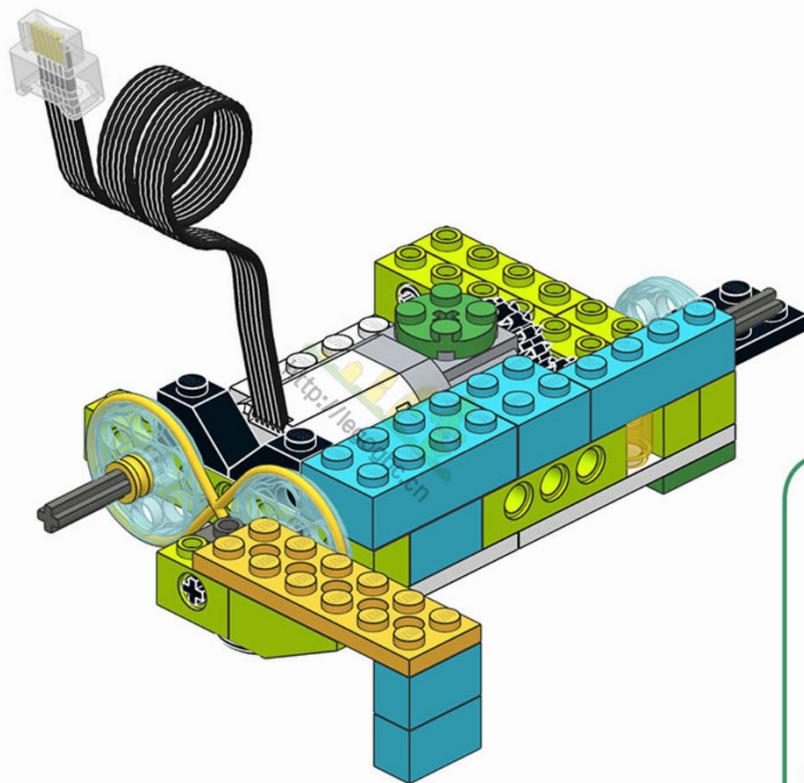
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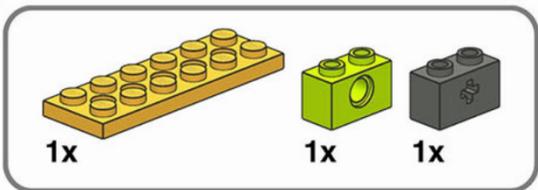
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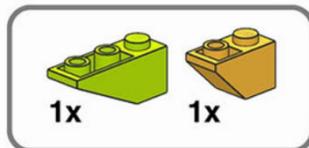
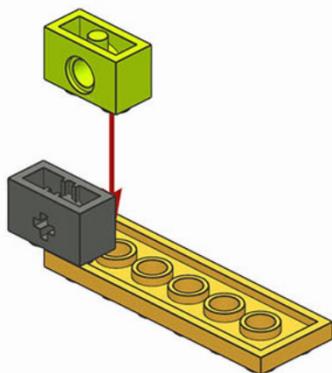




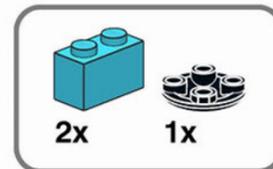
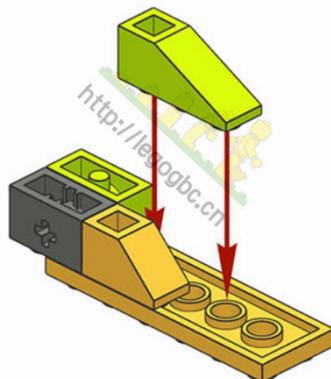
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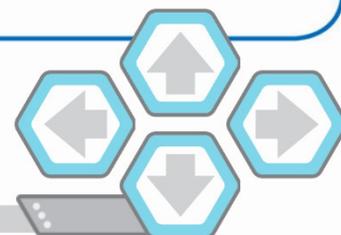
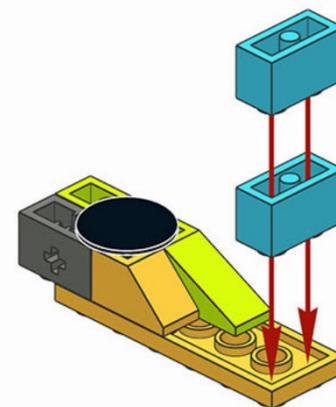
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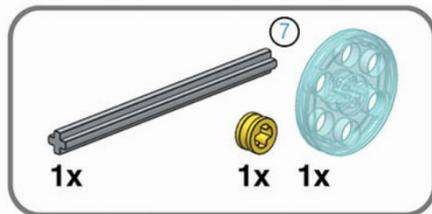
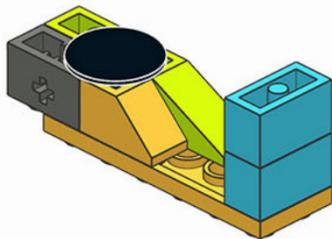
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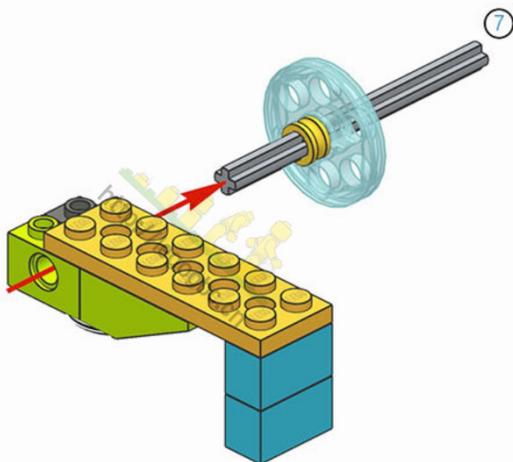


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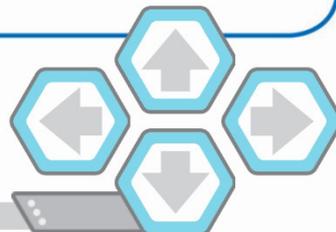
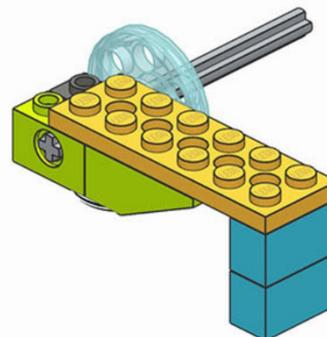
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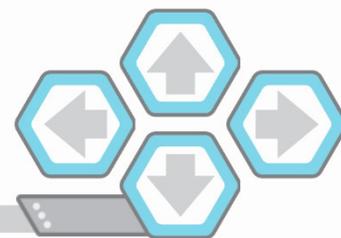
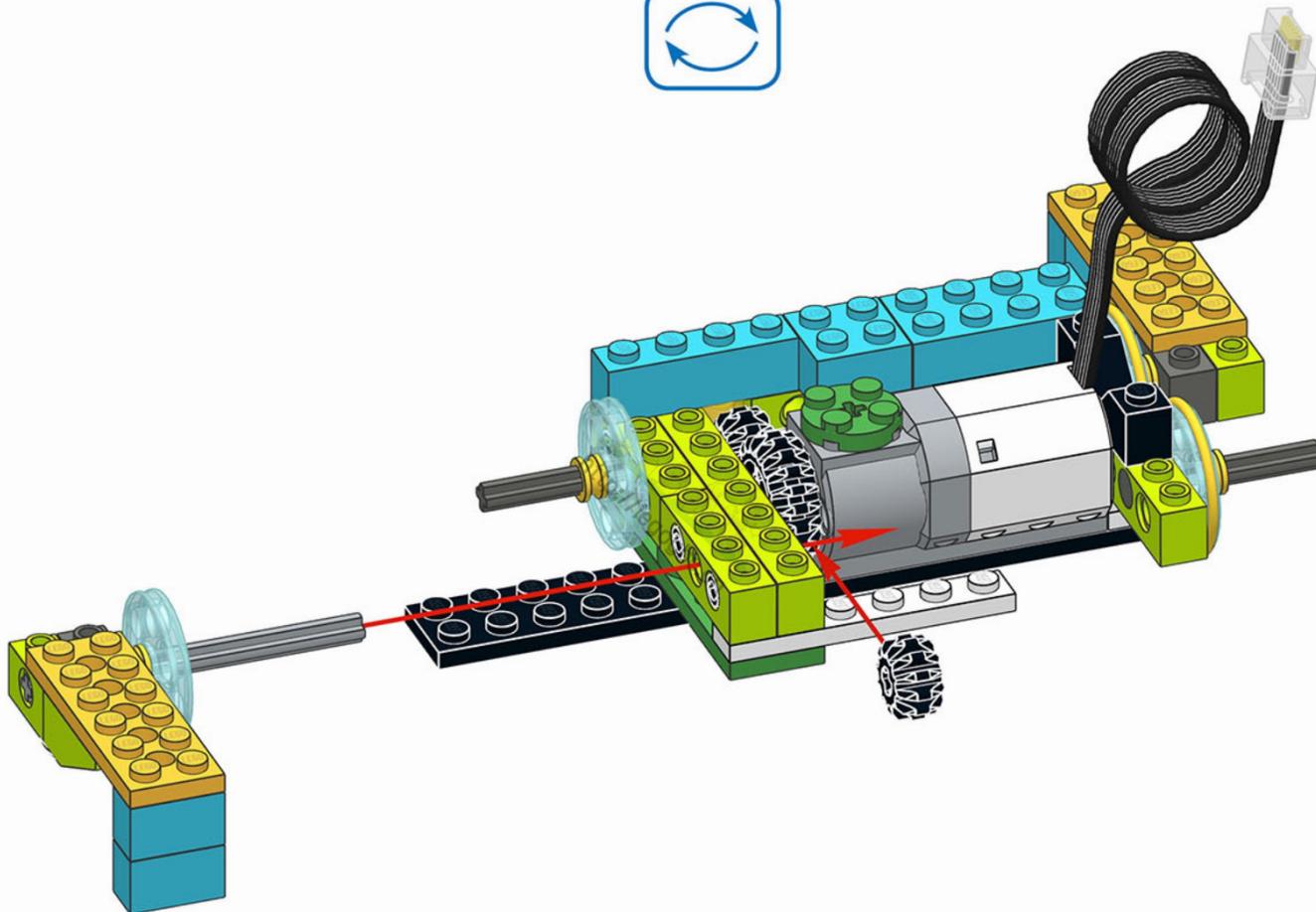




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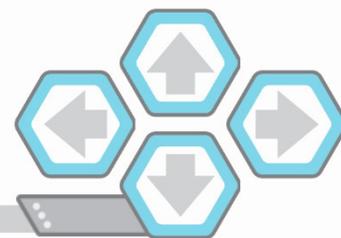
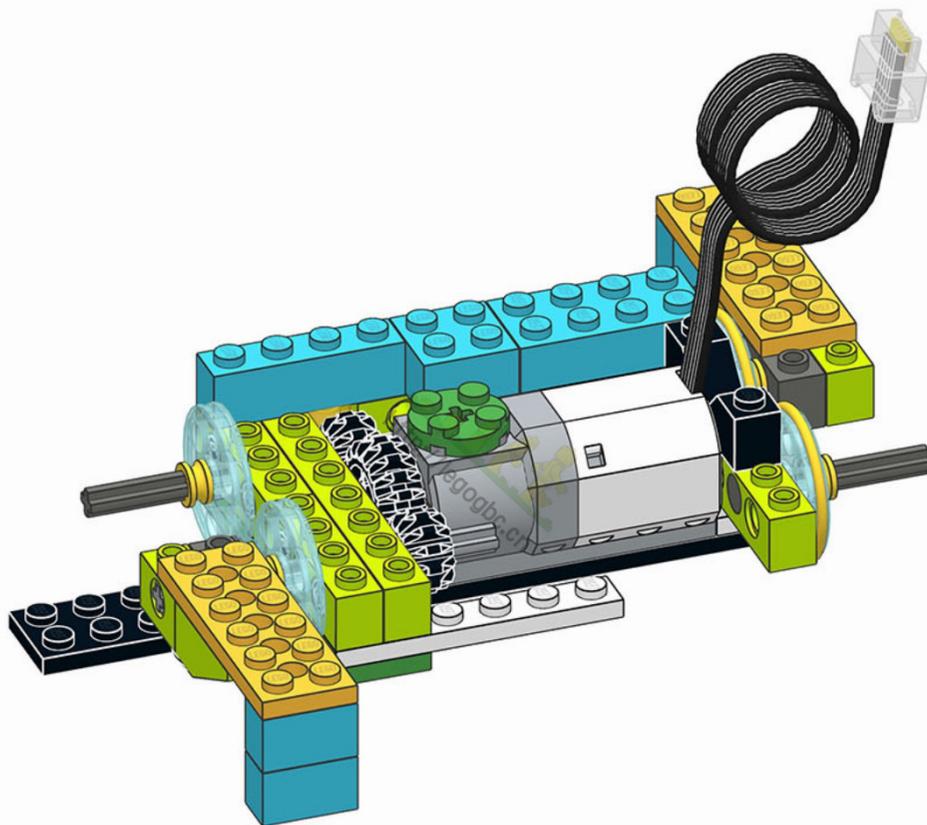
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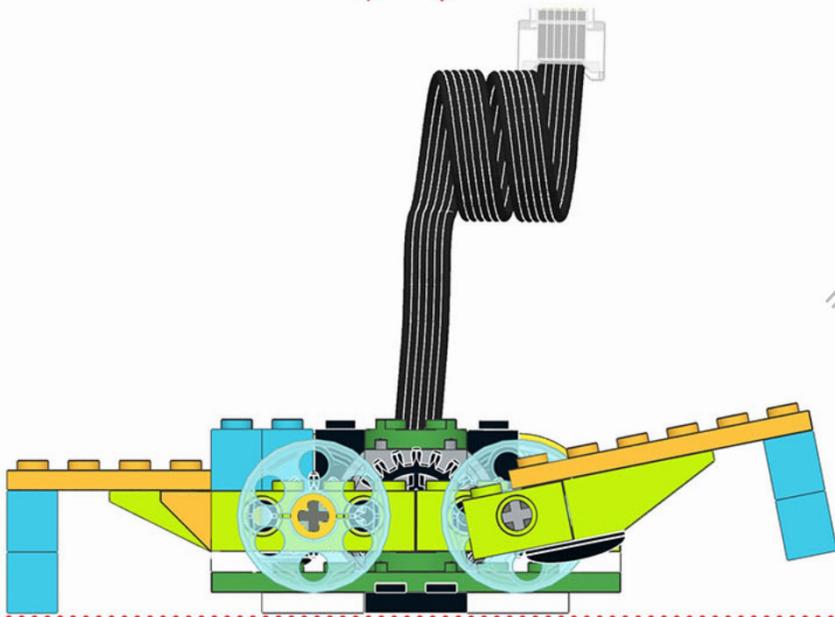
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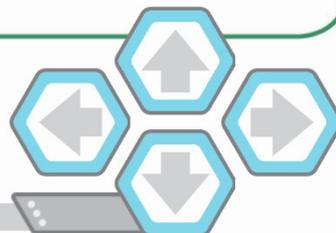
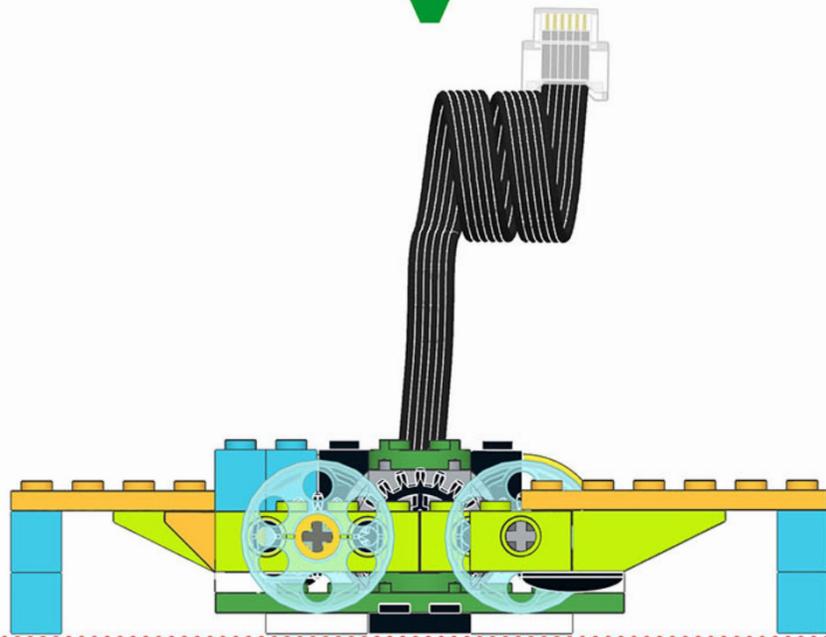




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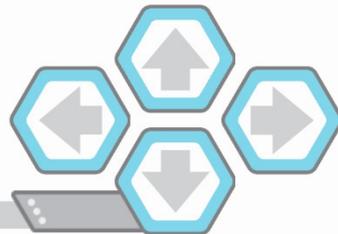
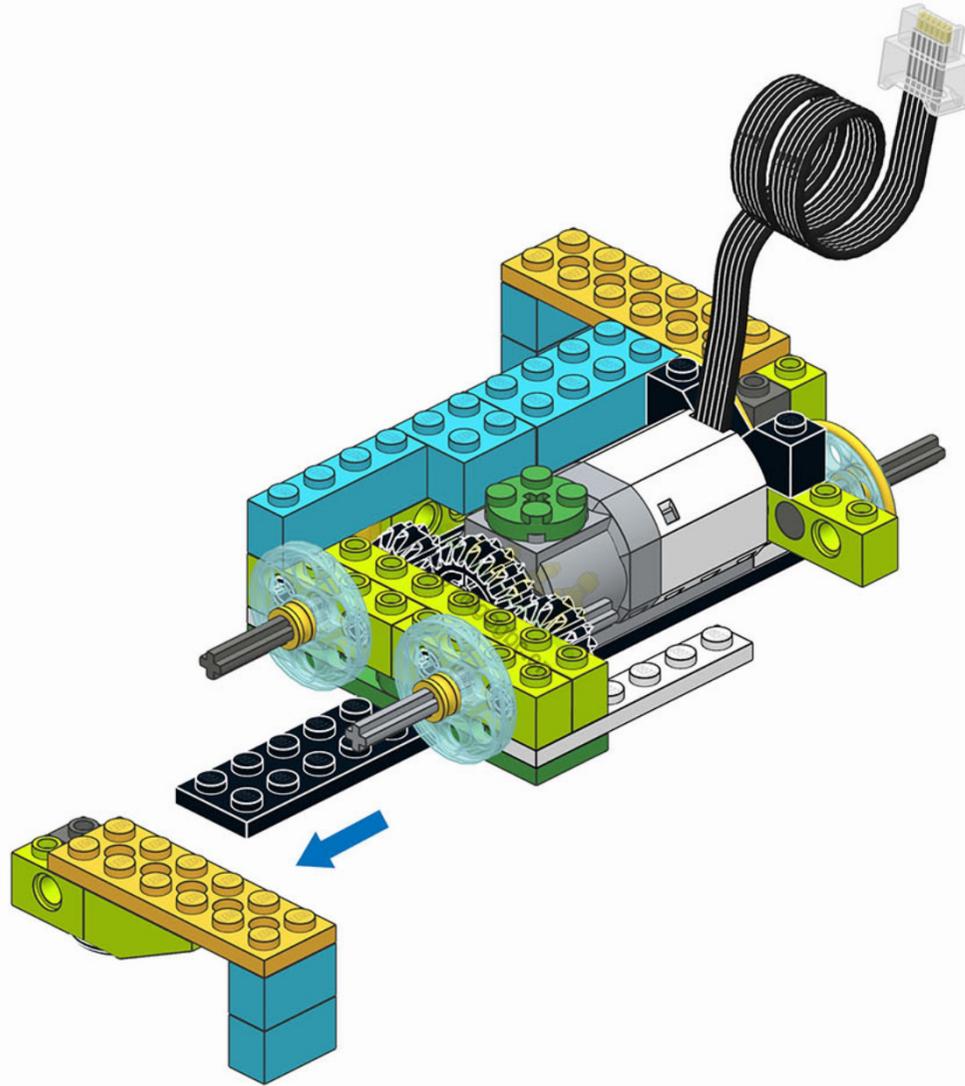
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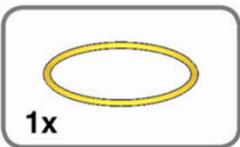
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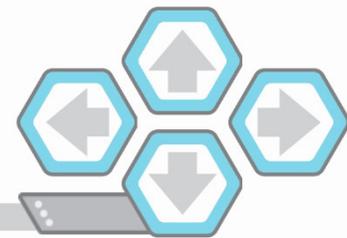
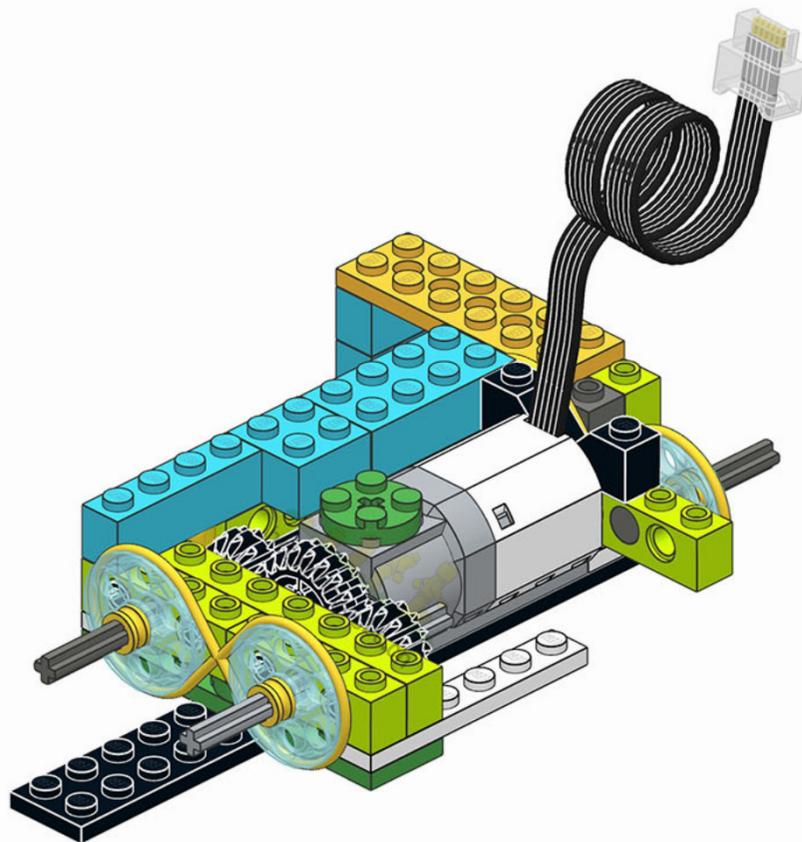




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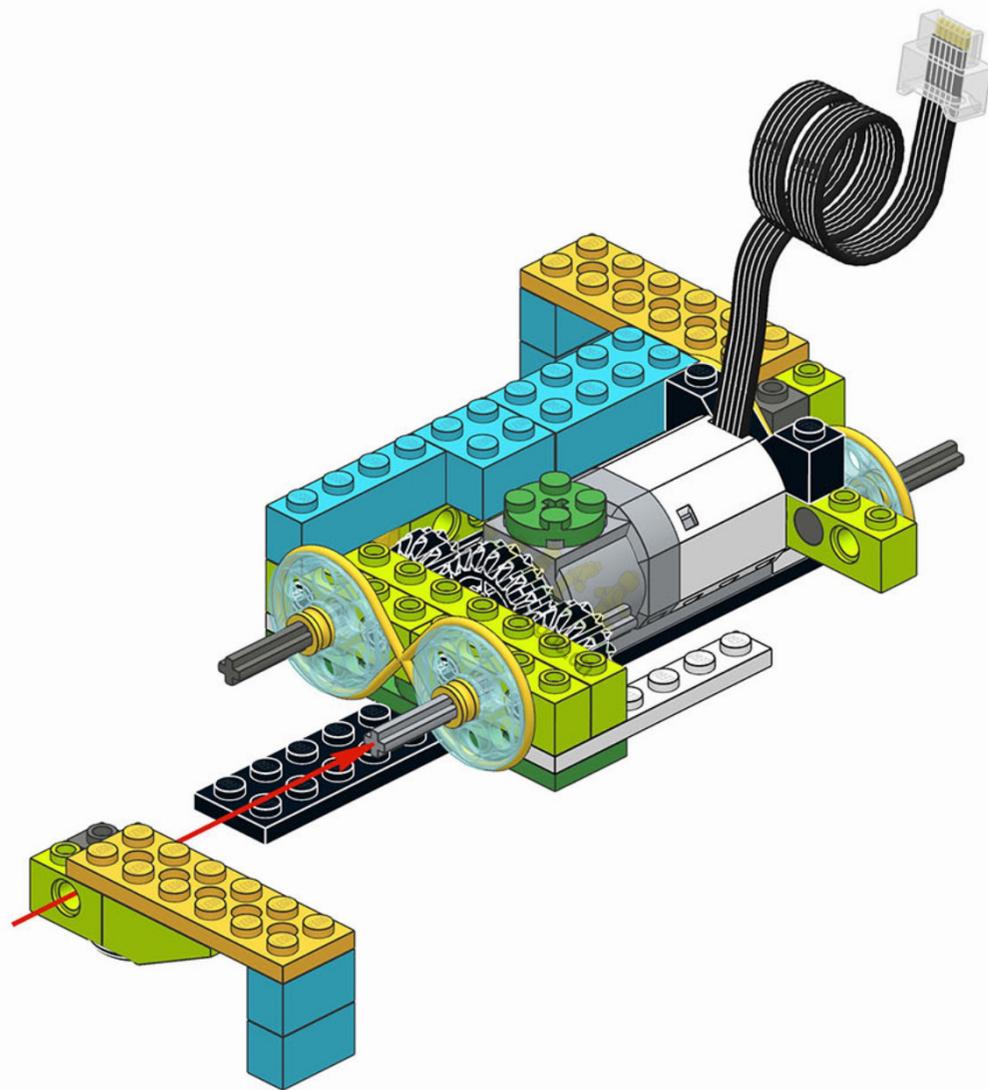
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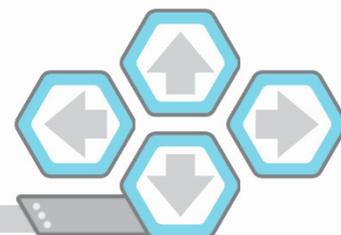
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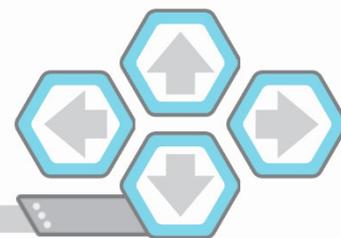
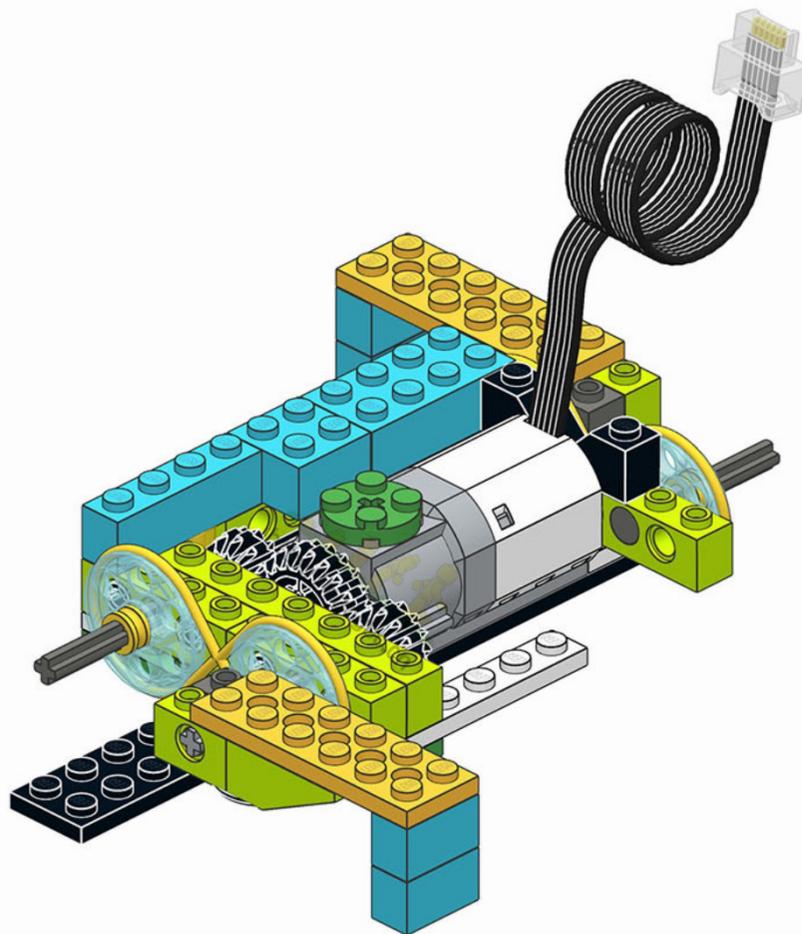
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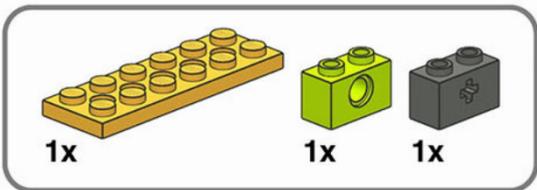
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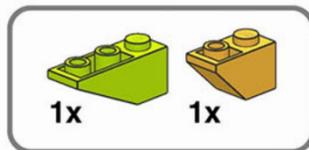
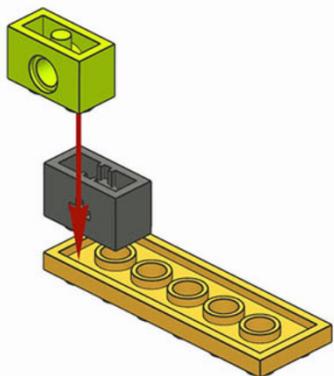




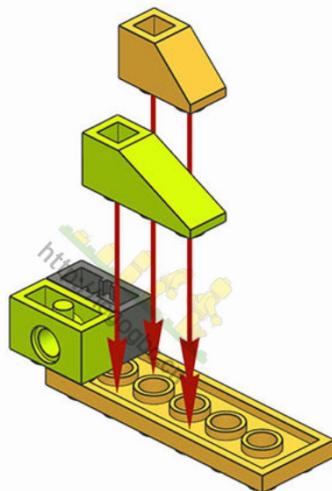
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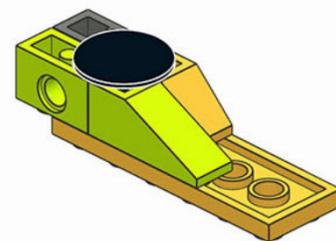
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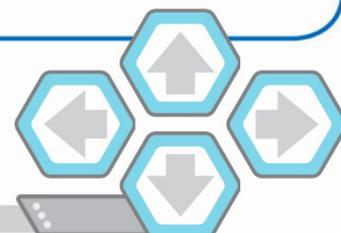
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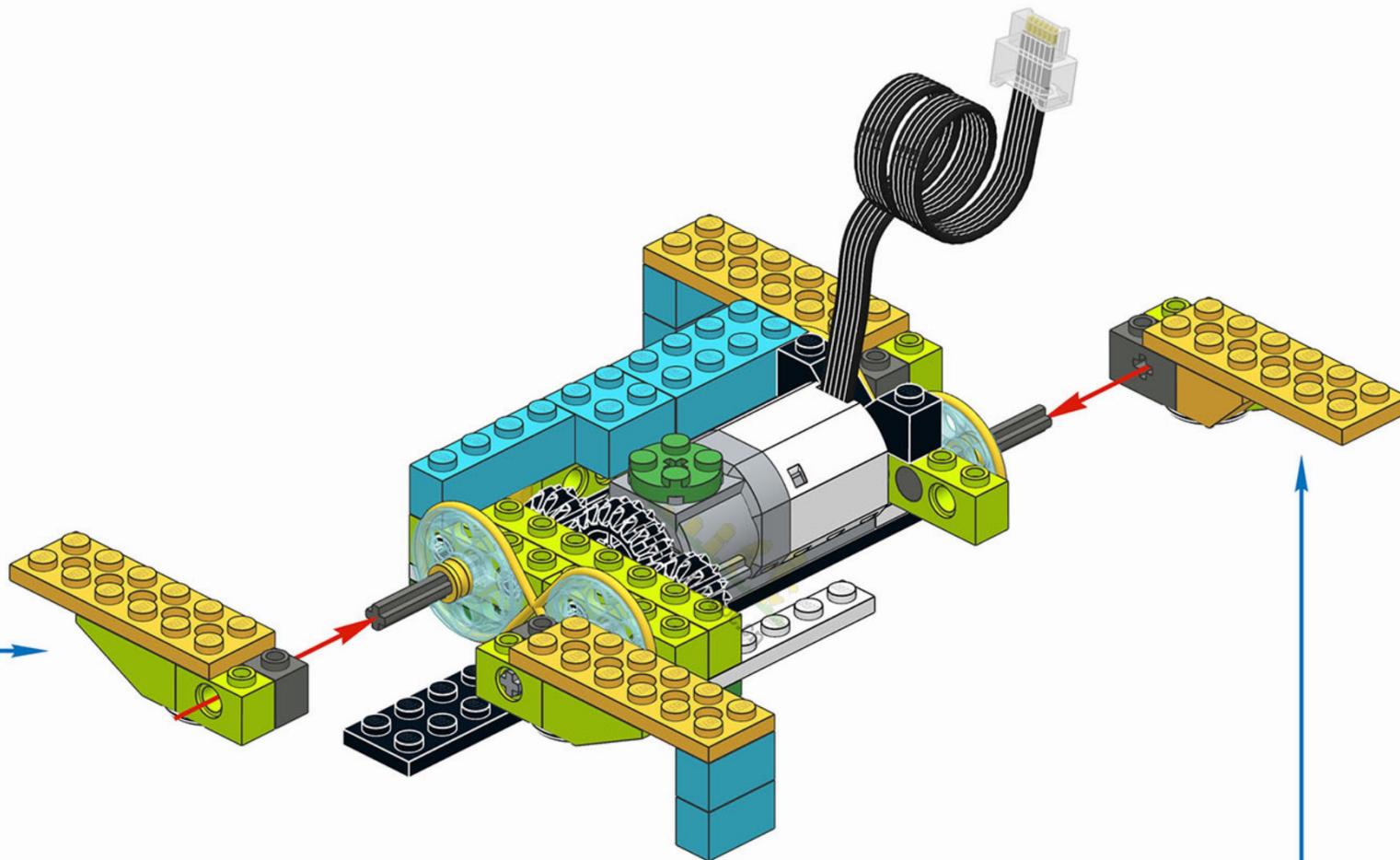
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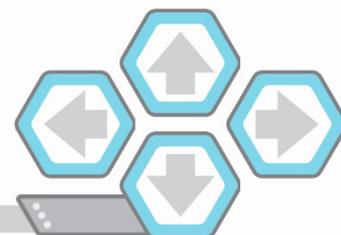
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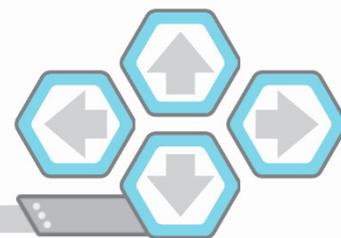
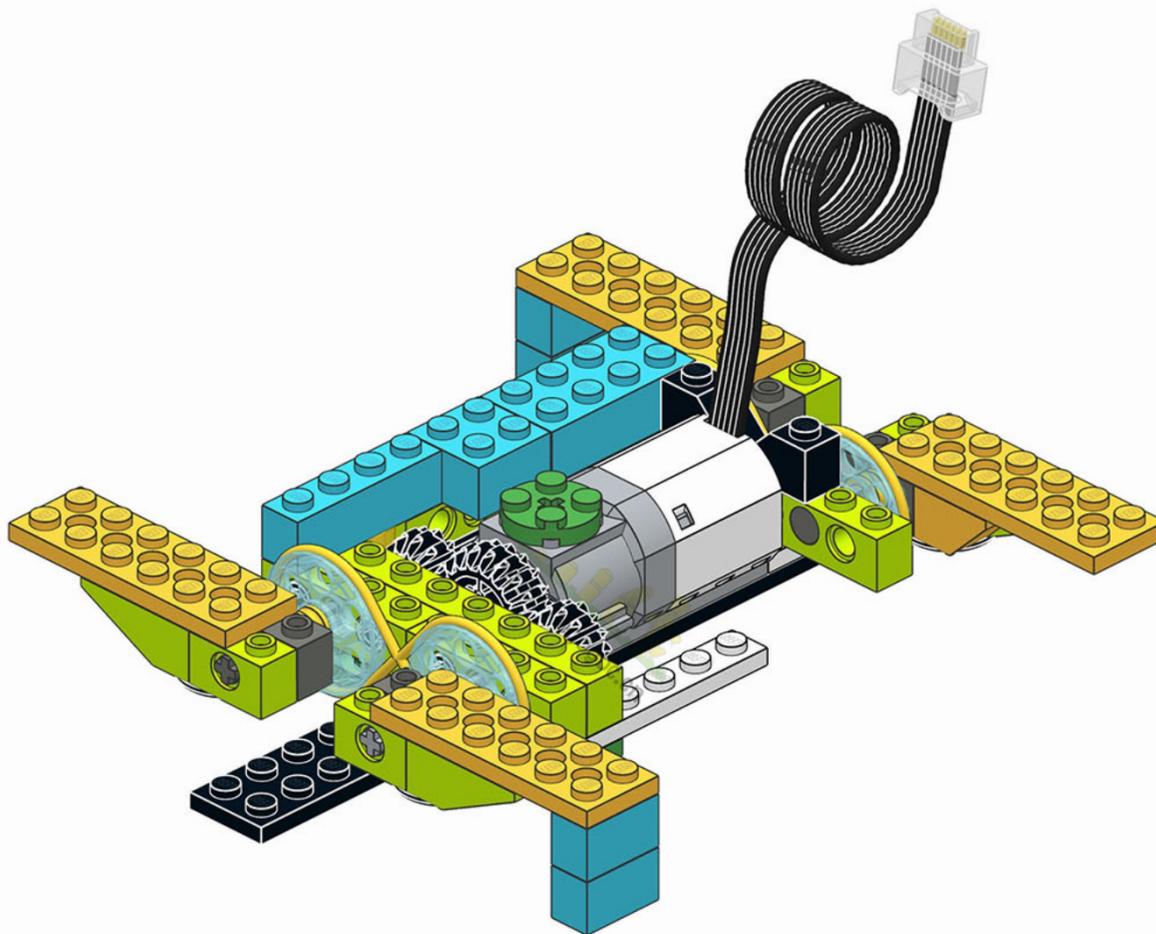
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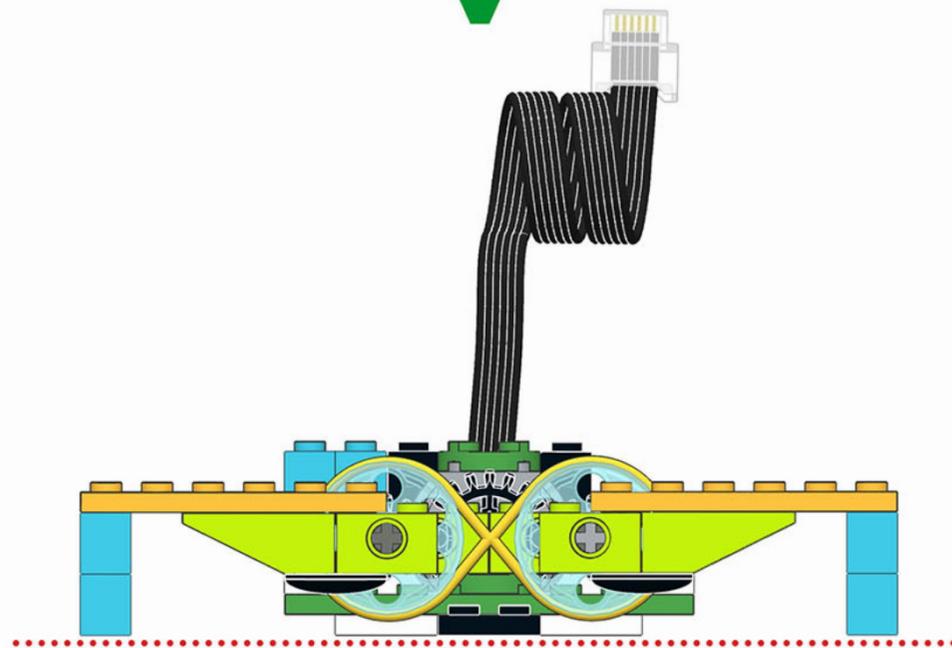
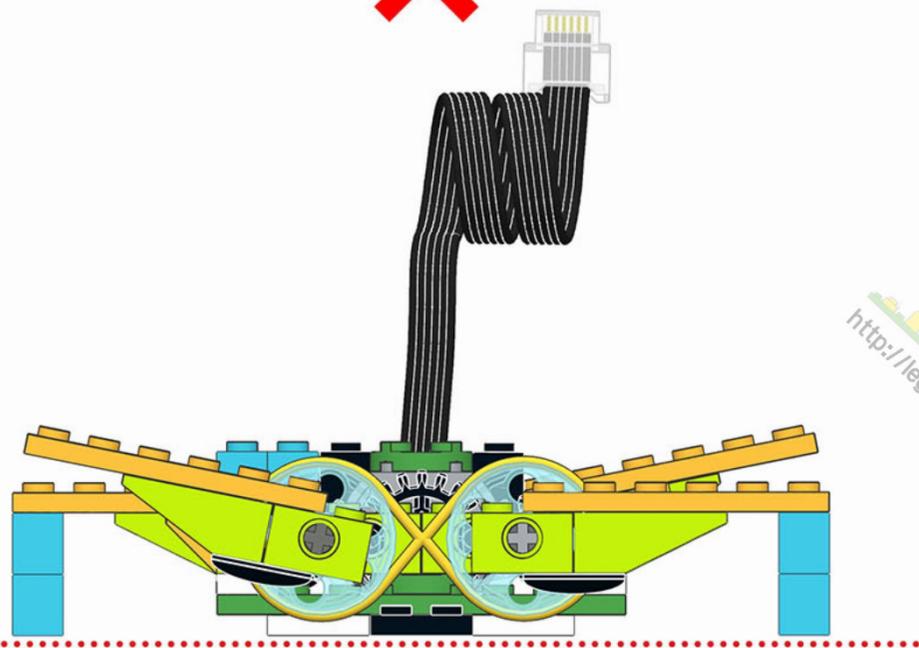
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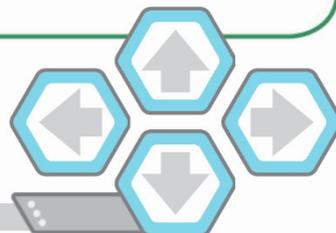


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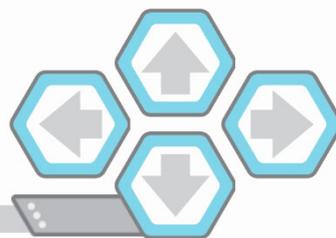
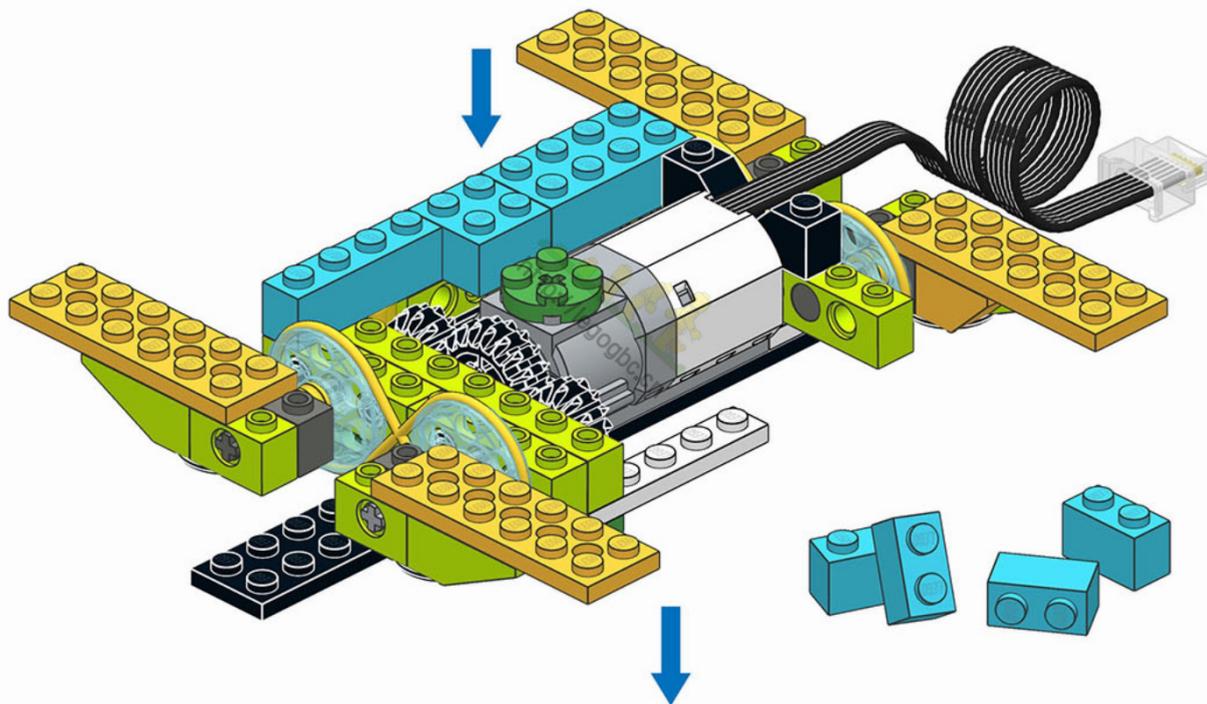
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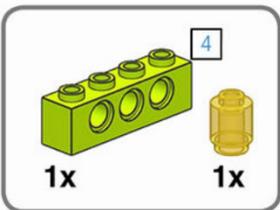
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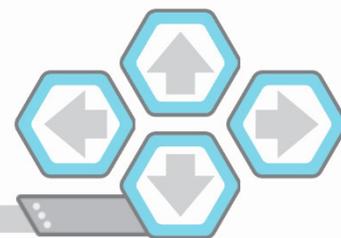
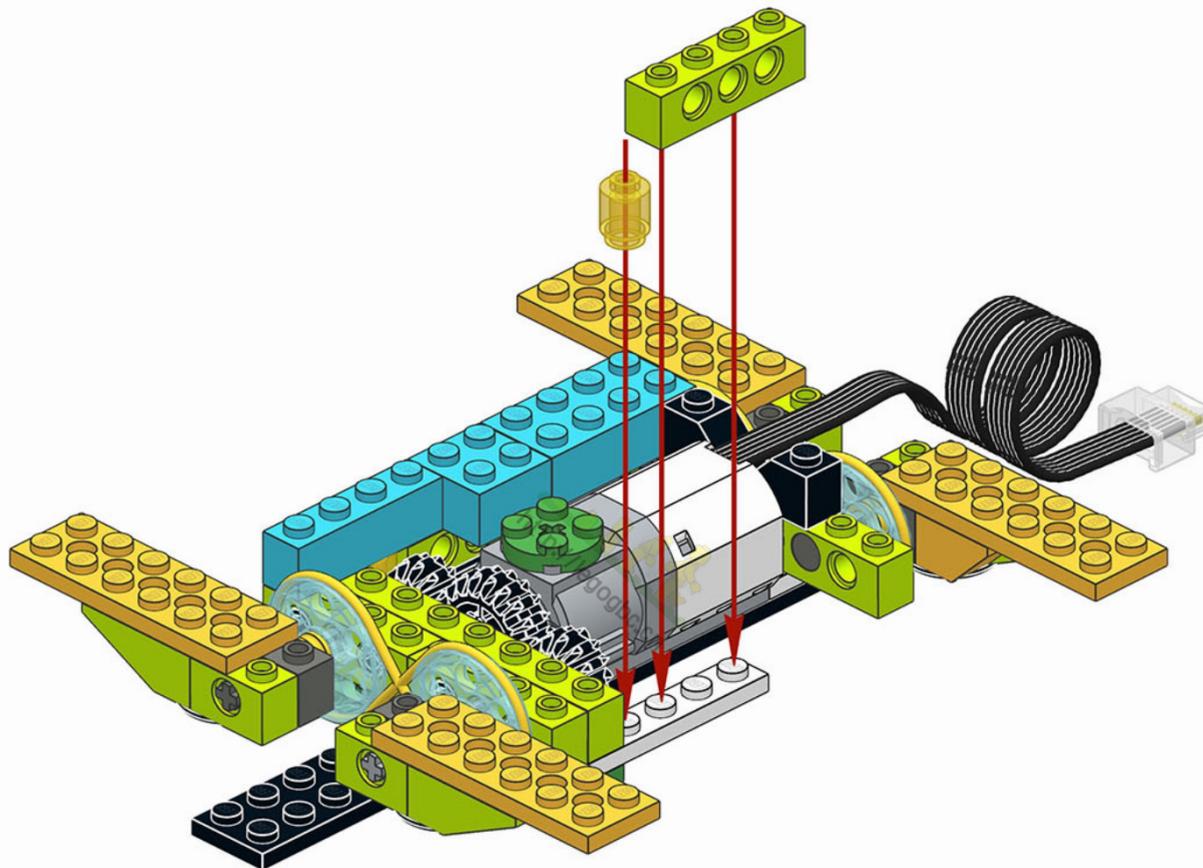




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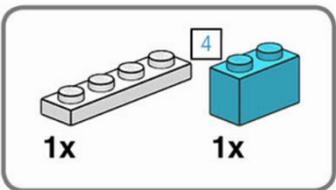


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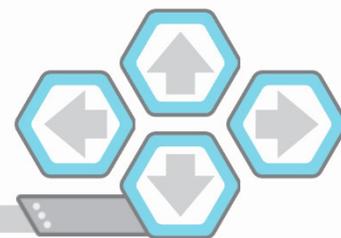
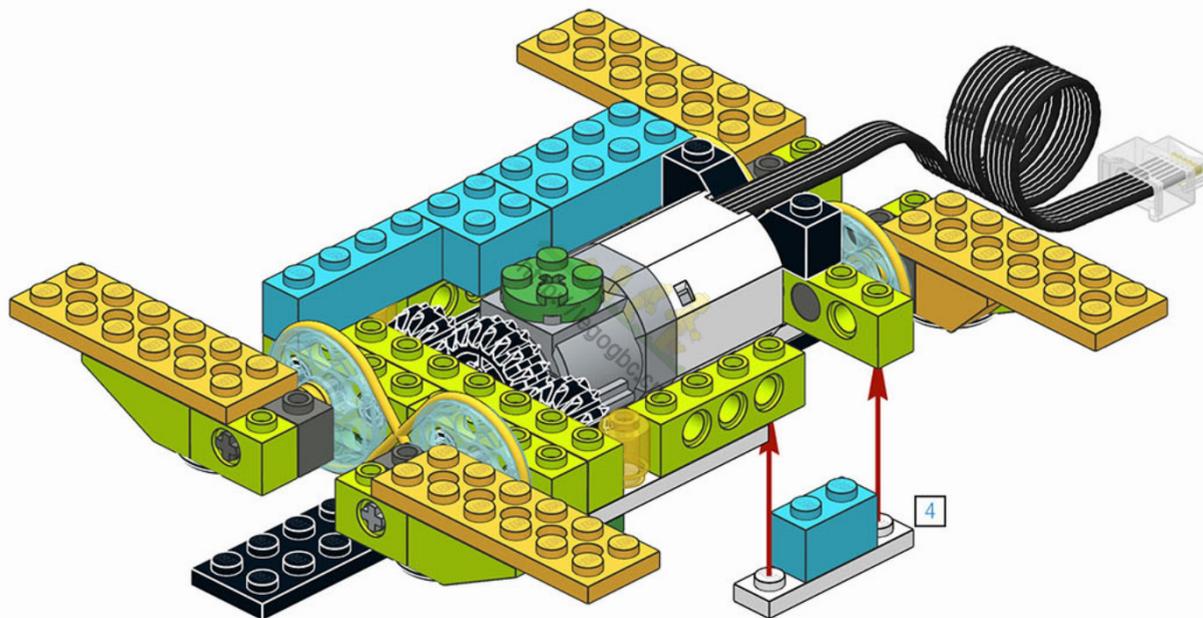




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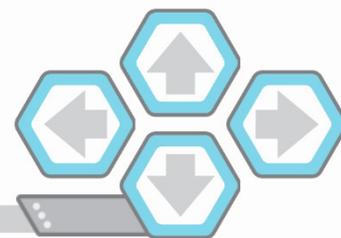
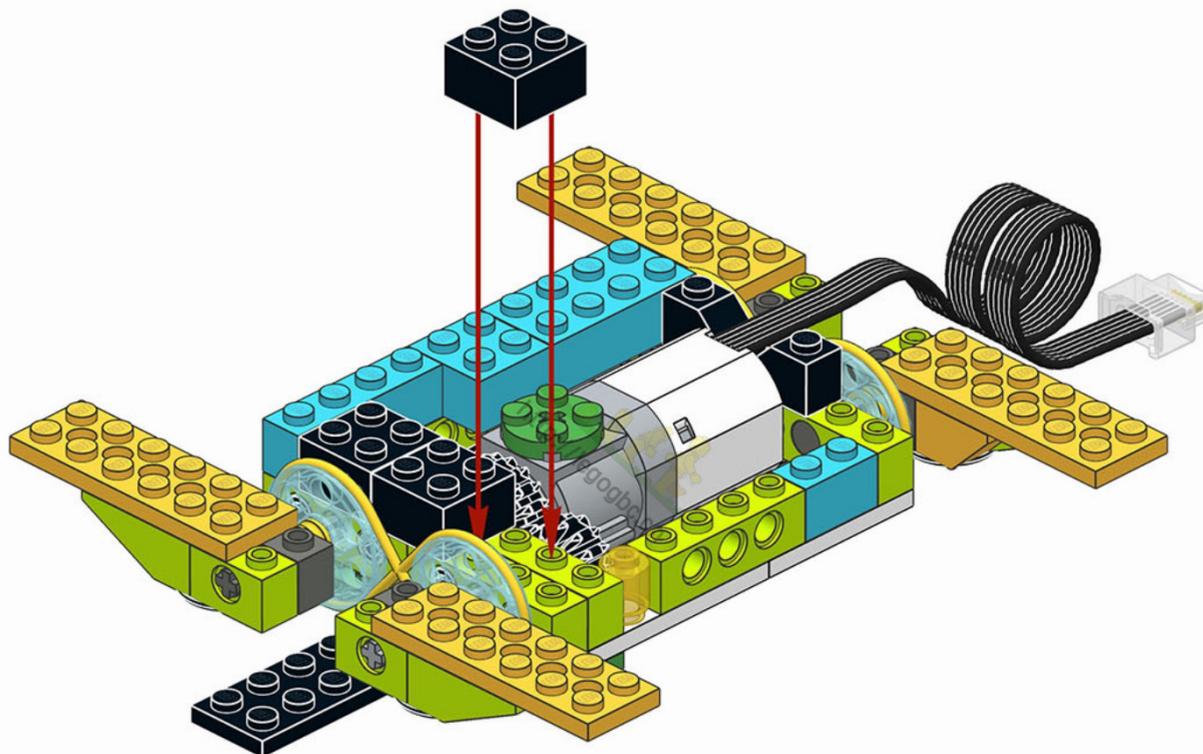


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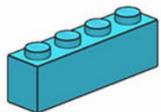
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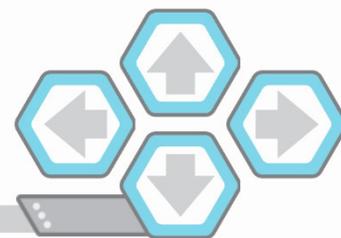
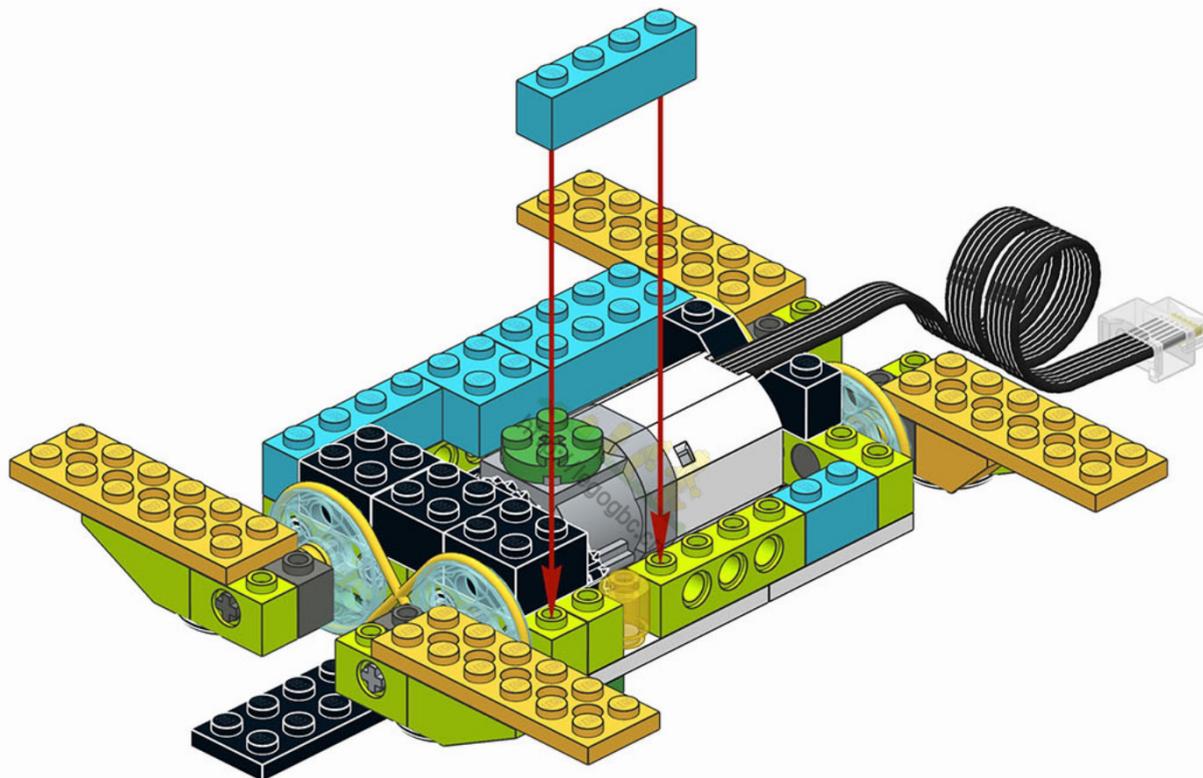


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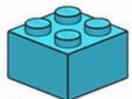
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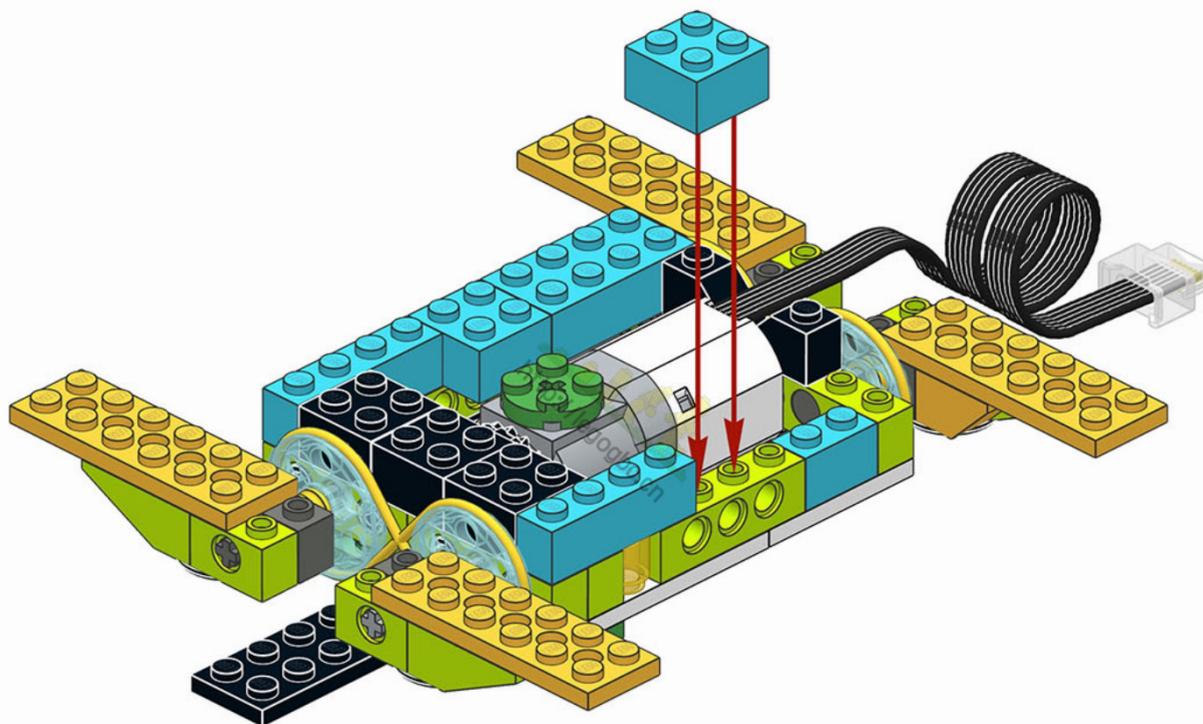


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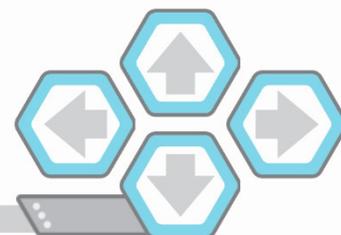
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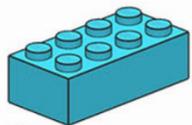
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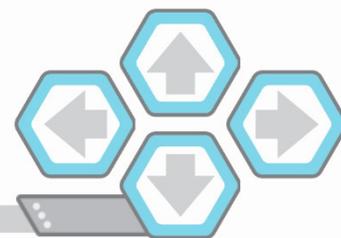
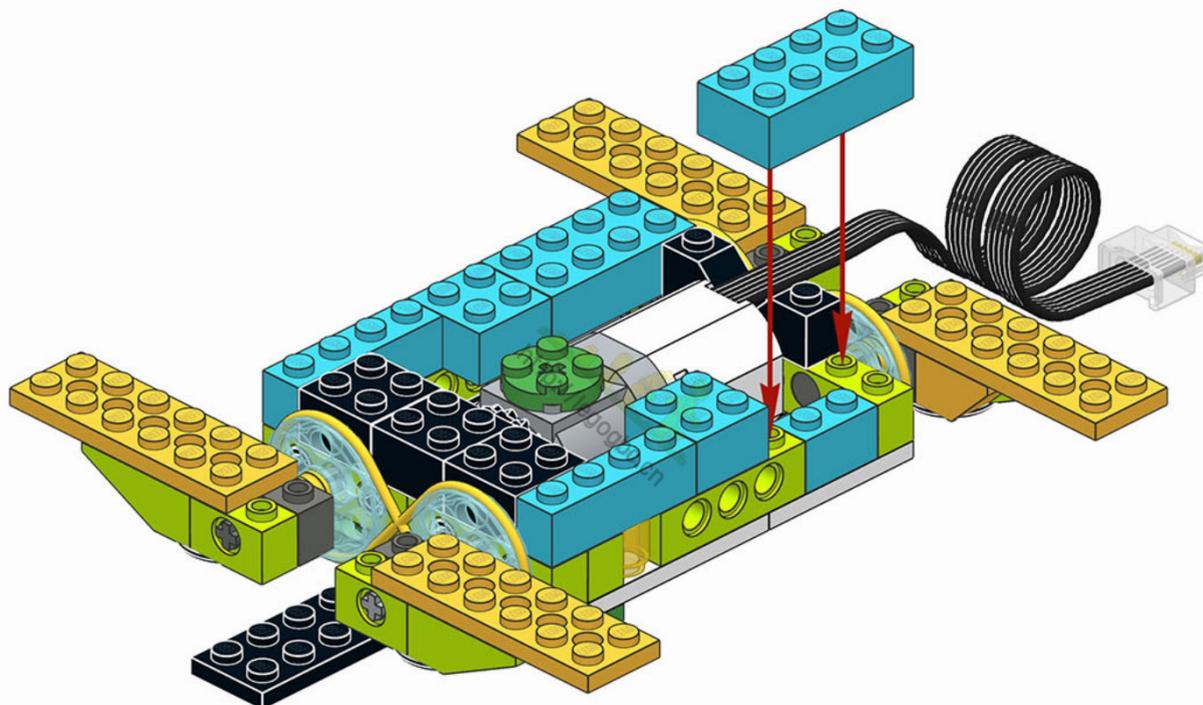


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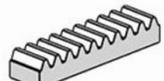
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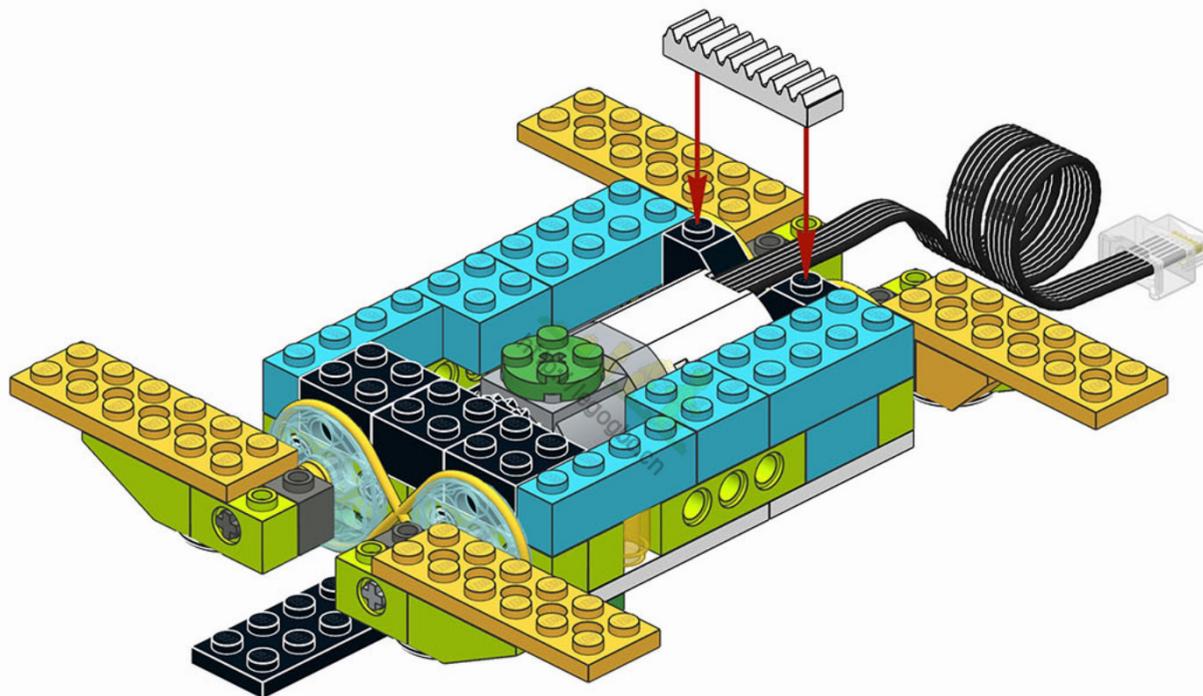


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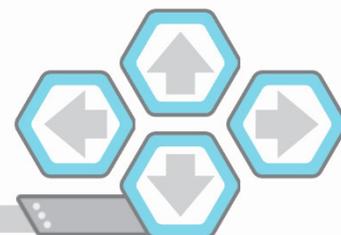
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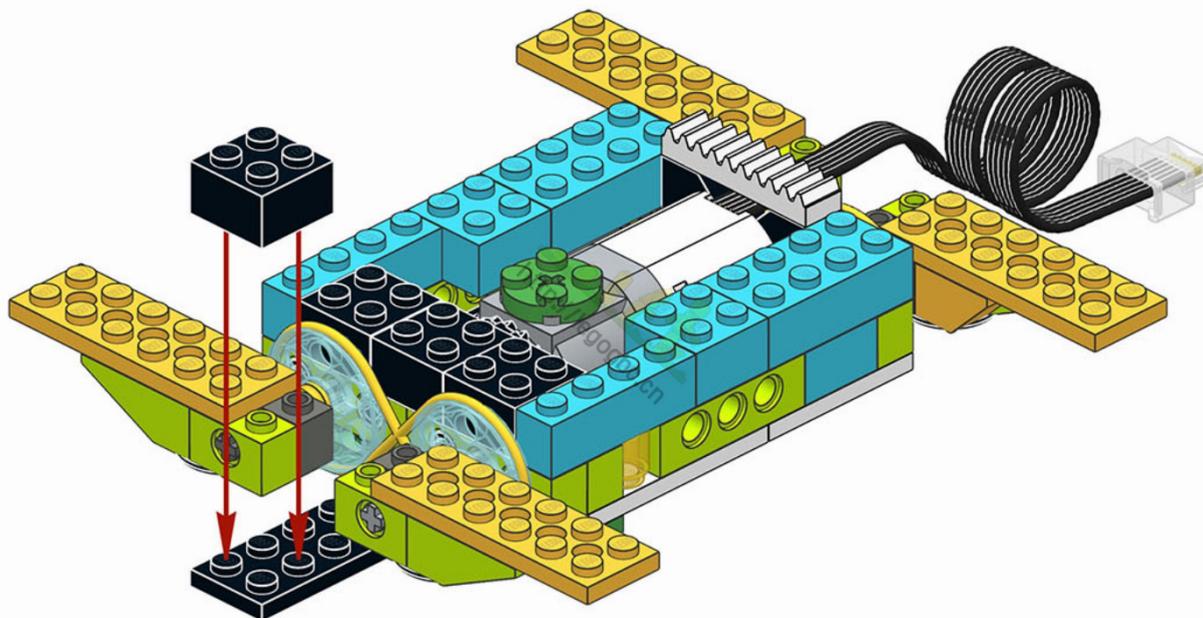


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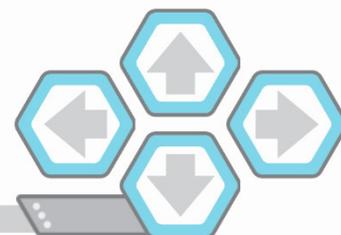
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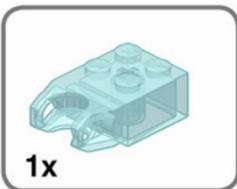
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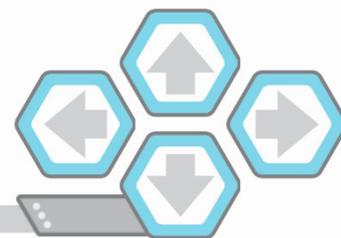
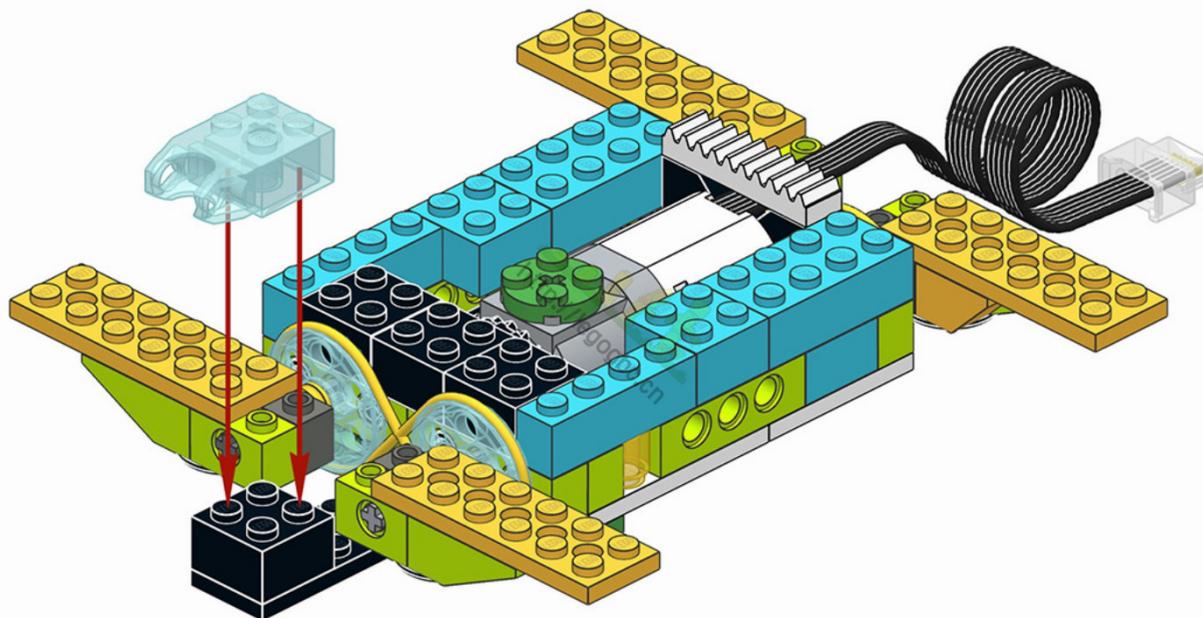




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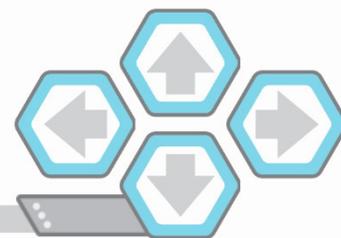
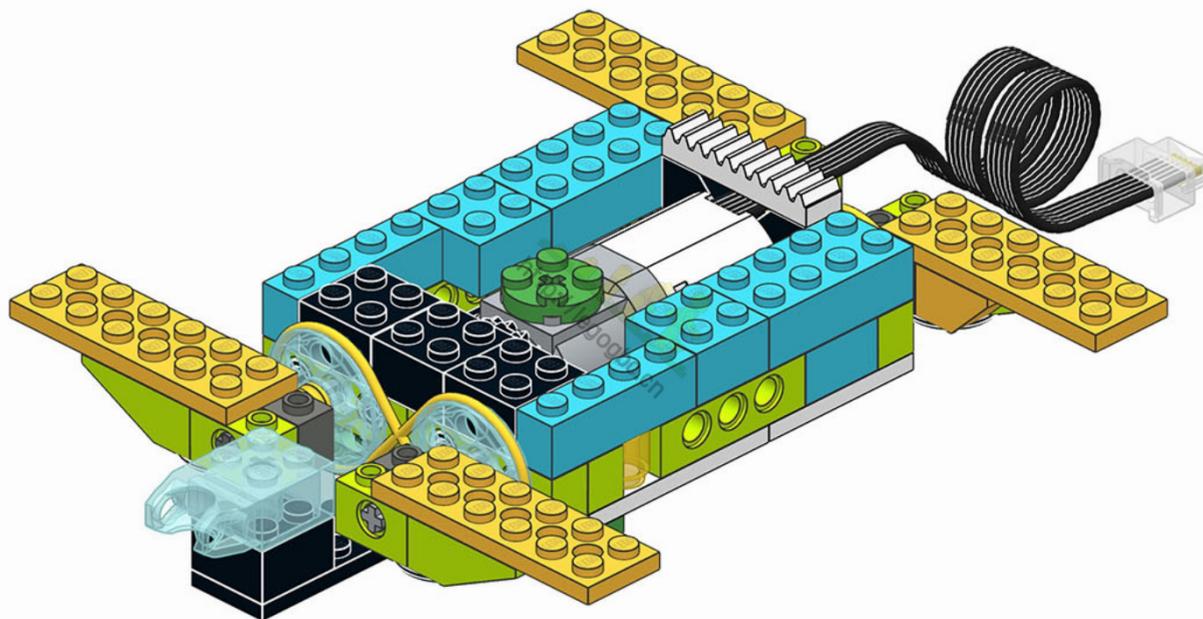
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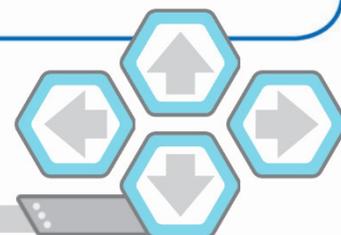
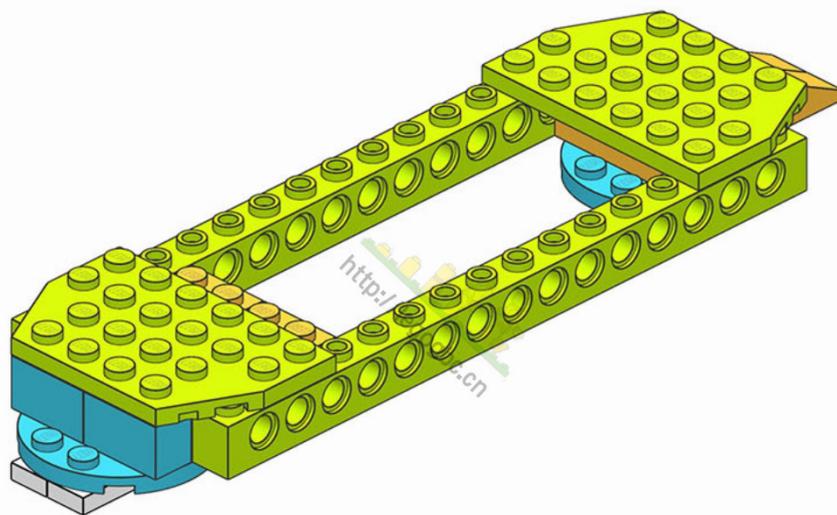
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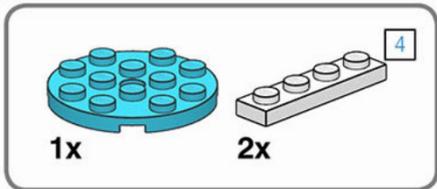


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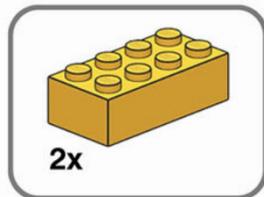
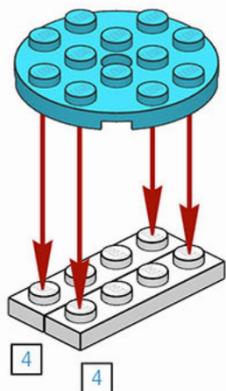




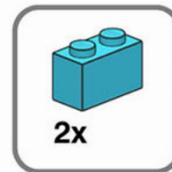
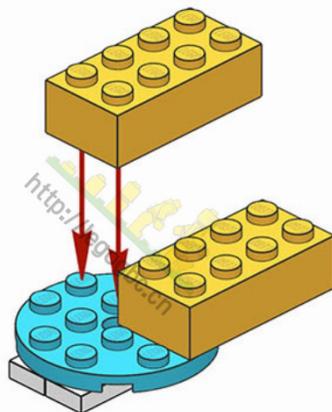
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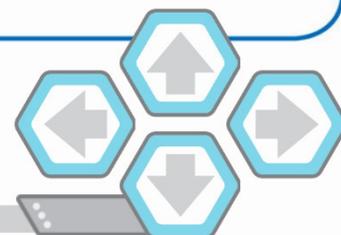
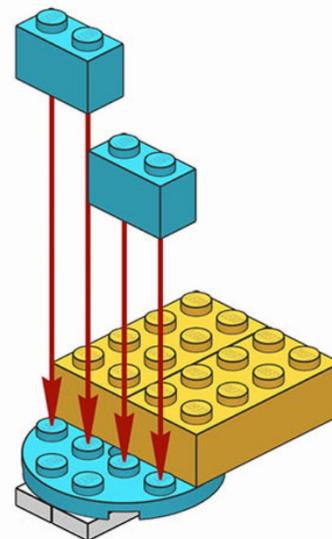
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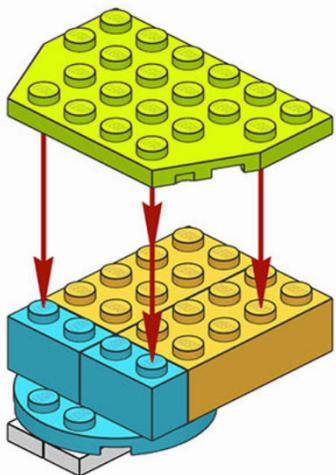


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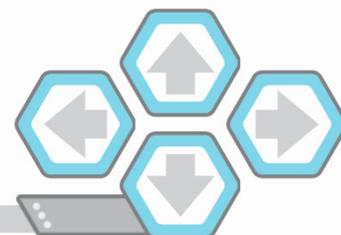
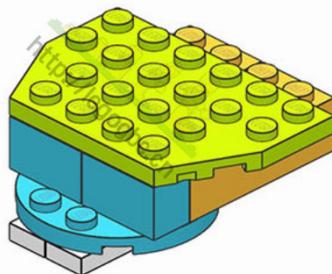


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4

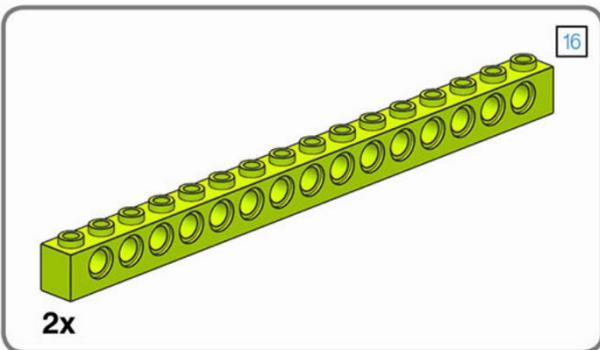


5

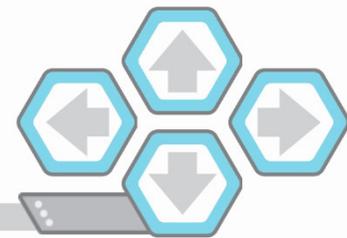
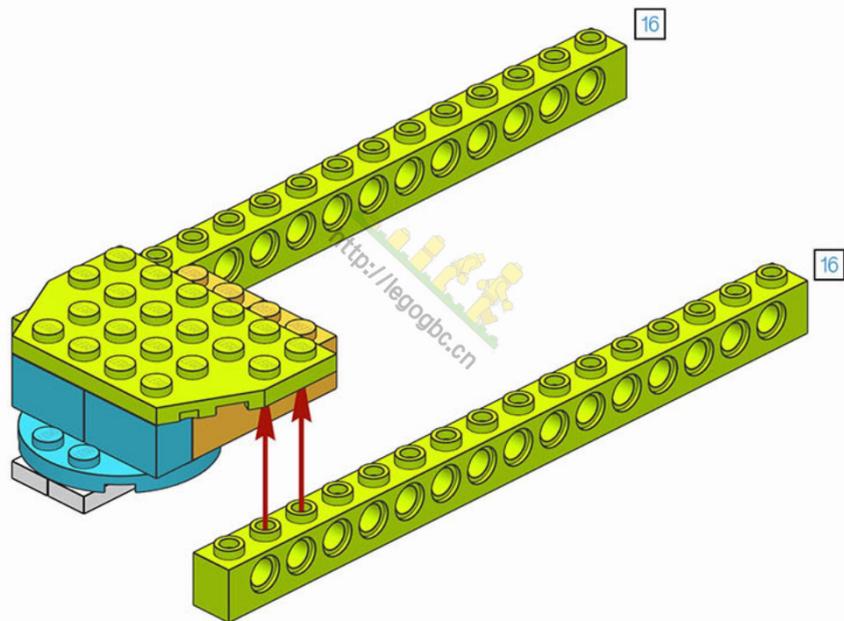




关注公众号获取更多



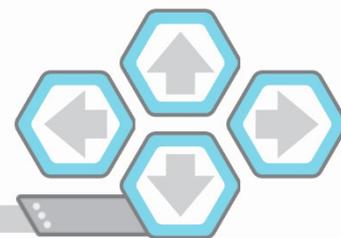
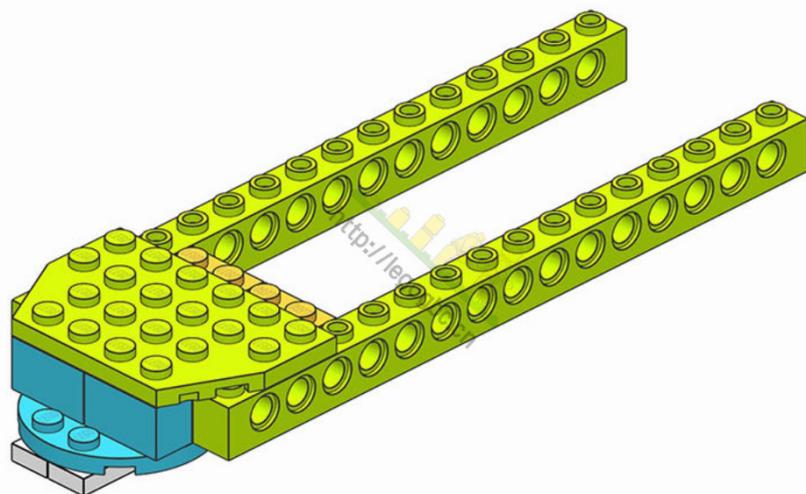
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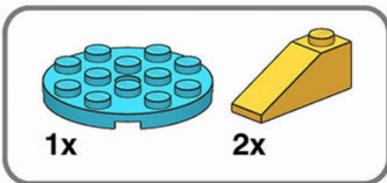
关注公众号获取更多

51

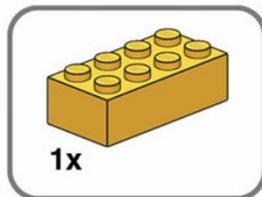
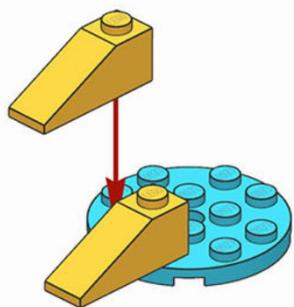




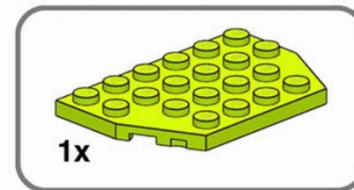
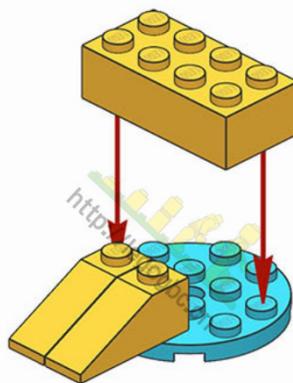
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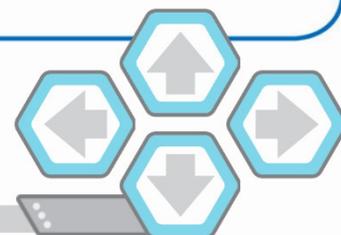
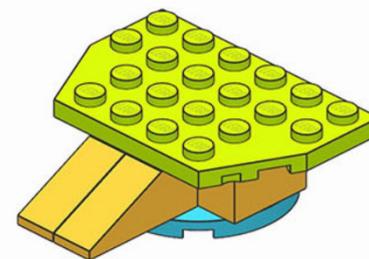
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2



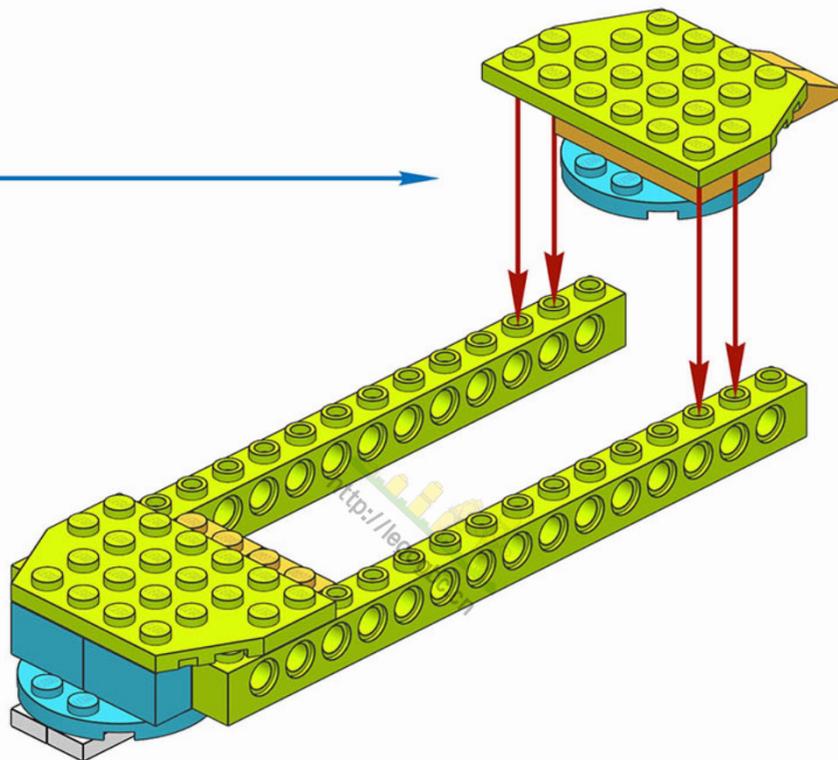
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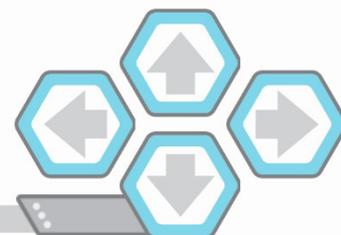
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53/67

3

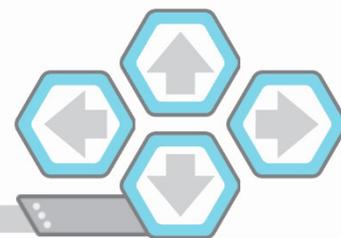
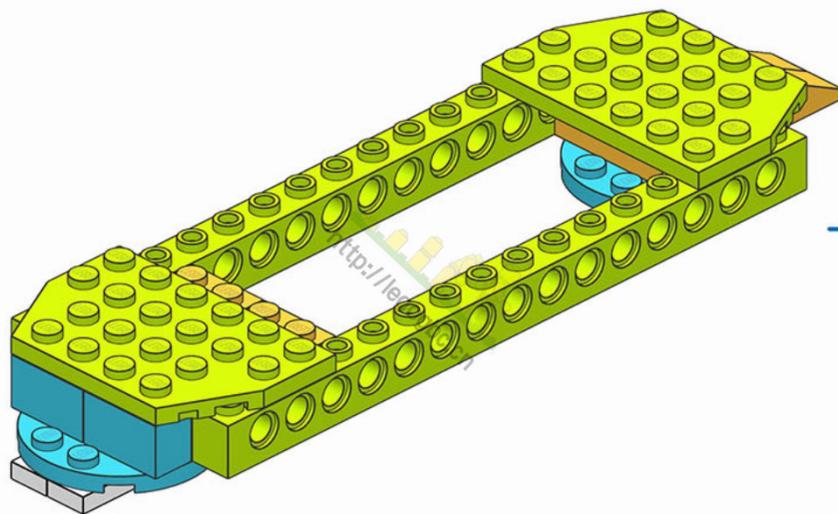
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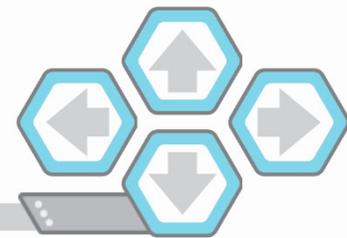
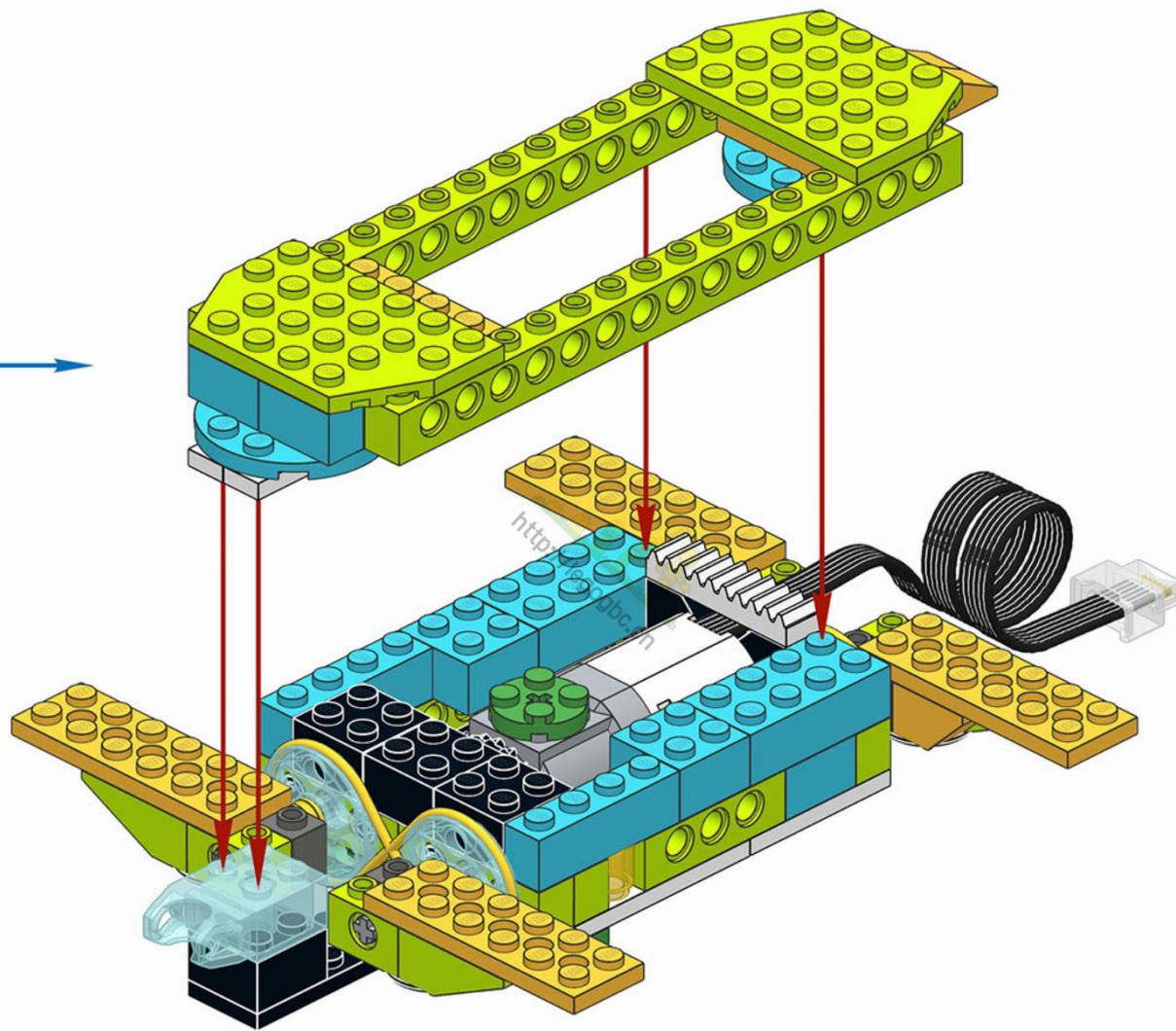
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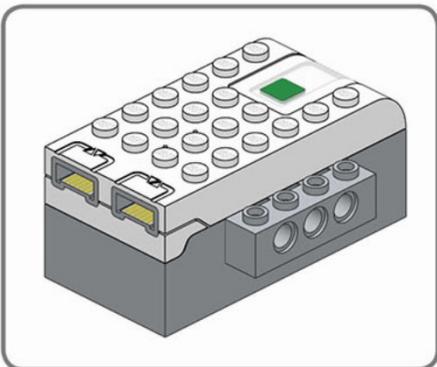
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55

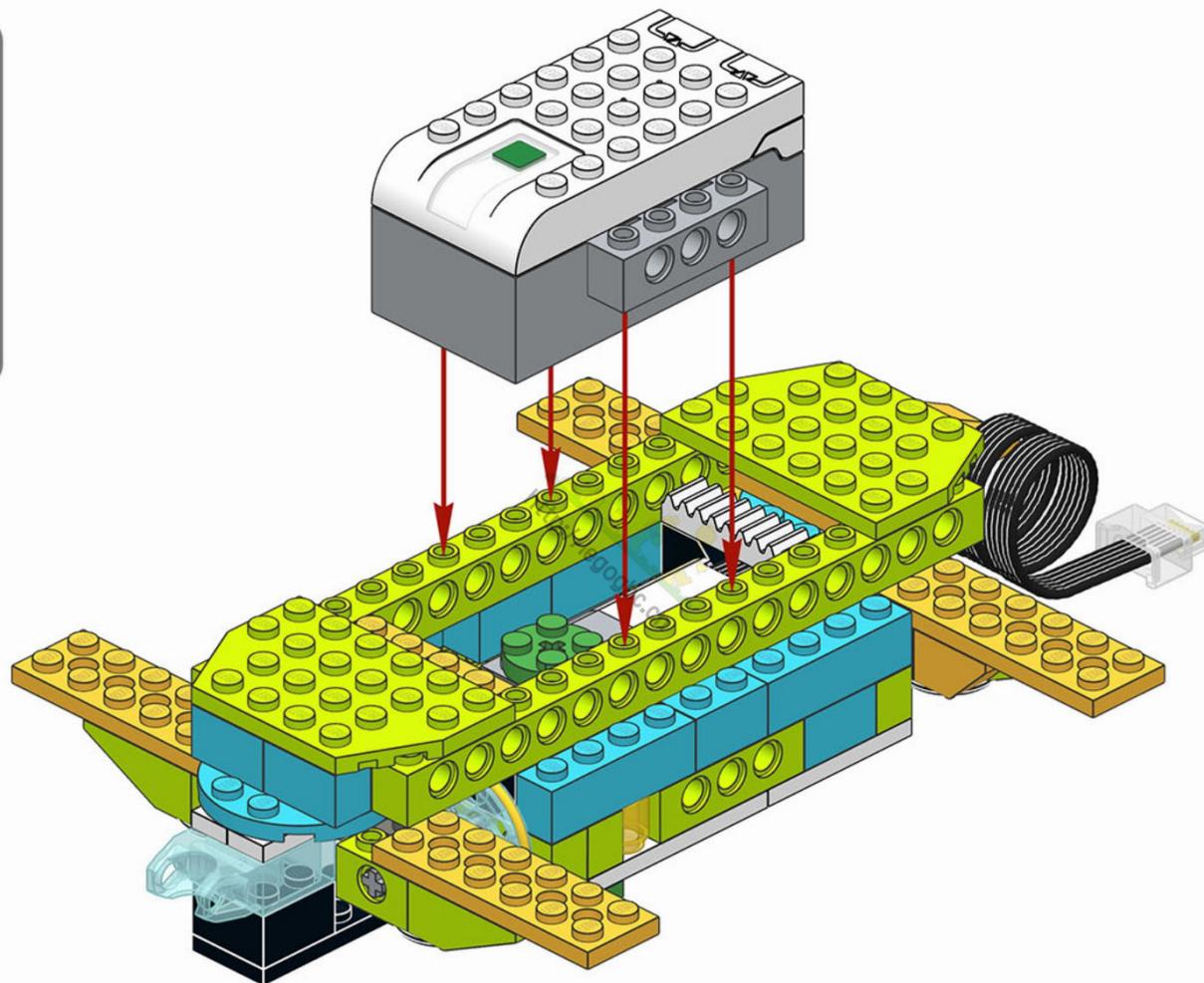




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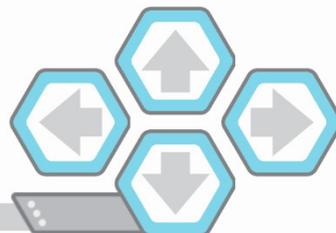
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3

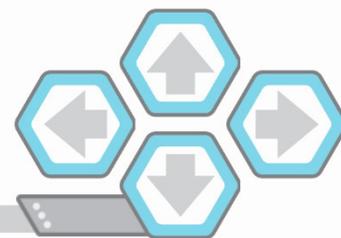
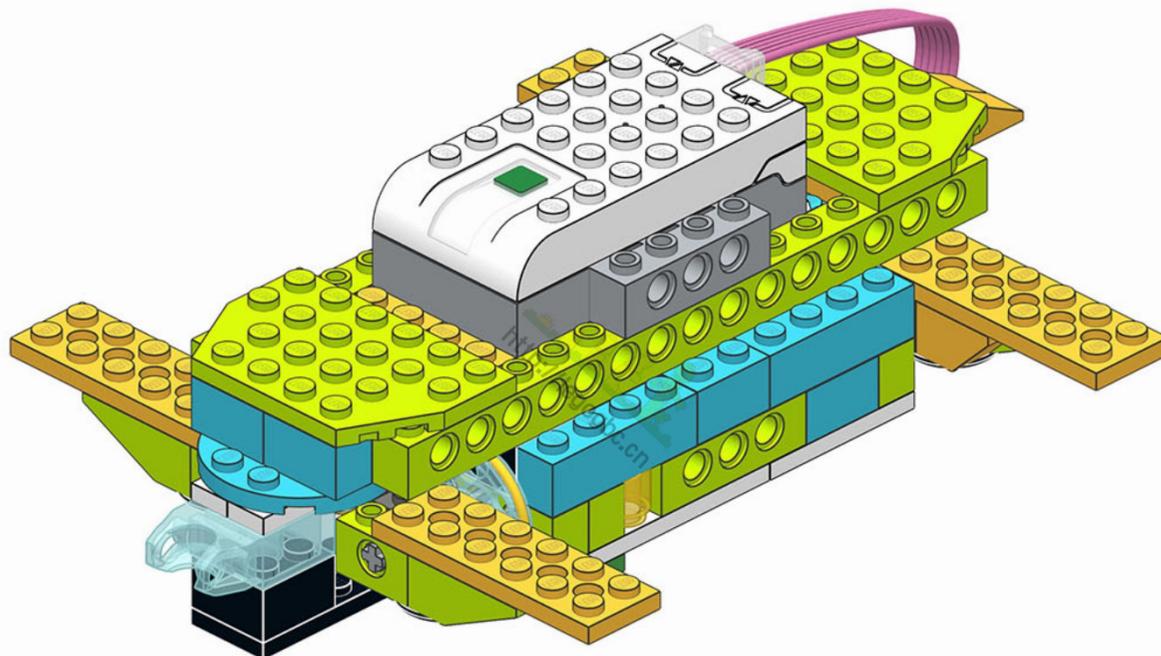
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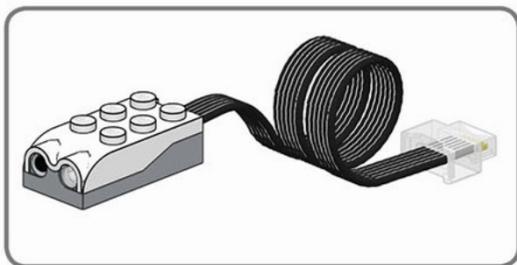
关注公众号获取更多

57

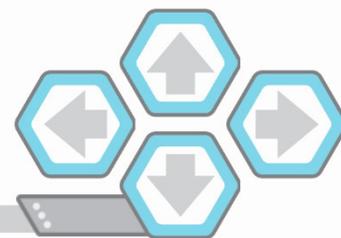
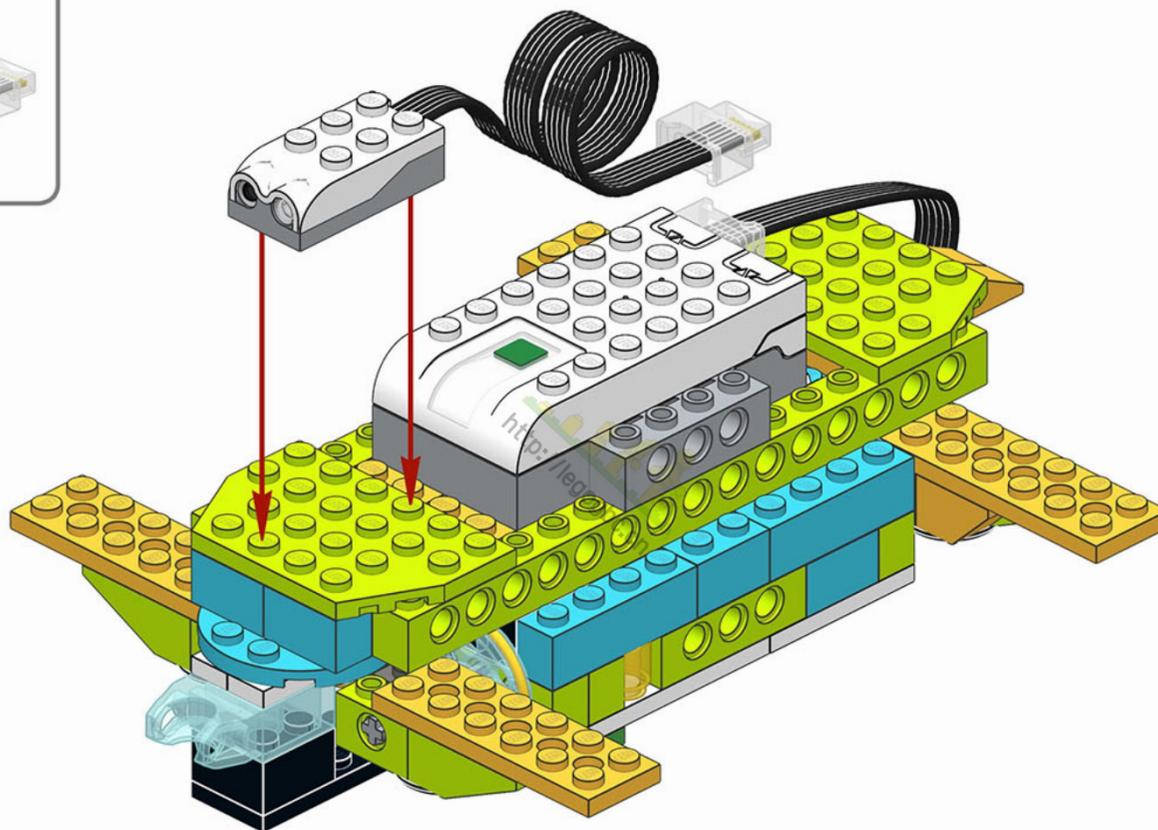




关注公众号获取更多



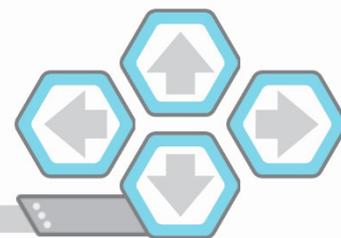
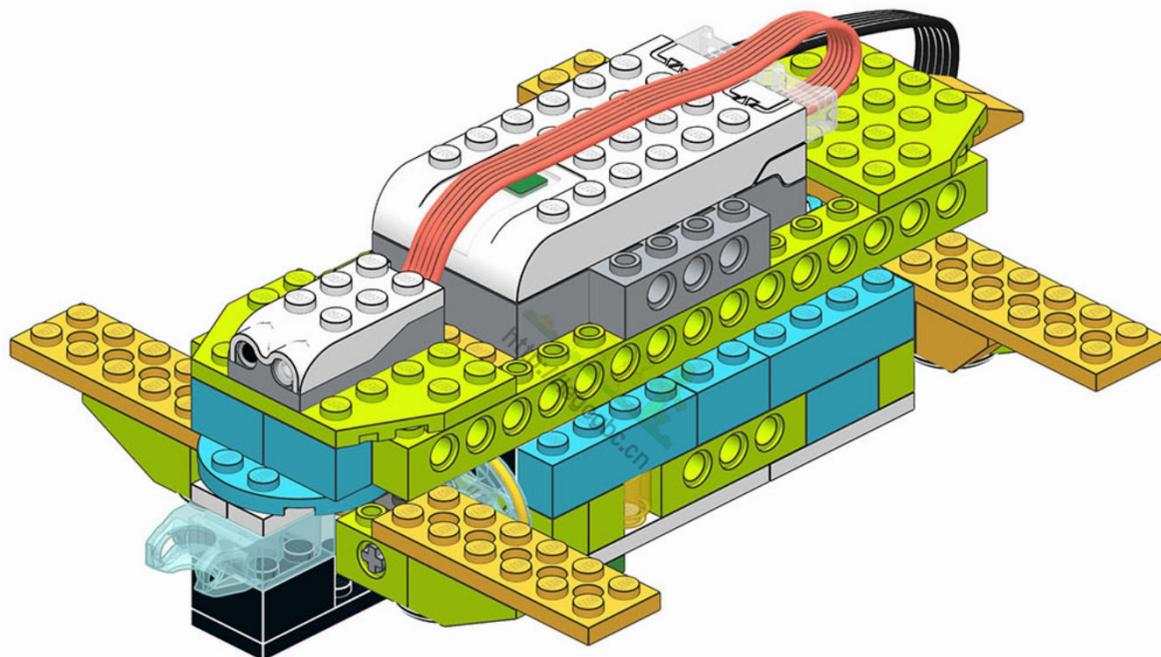
58





关注公众号获取更多

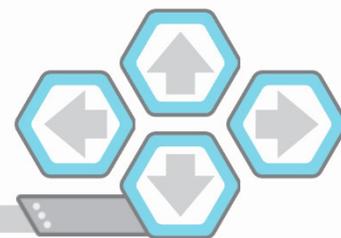
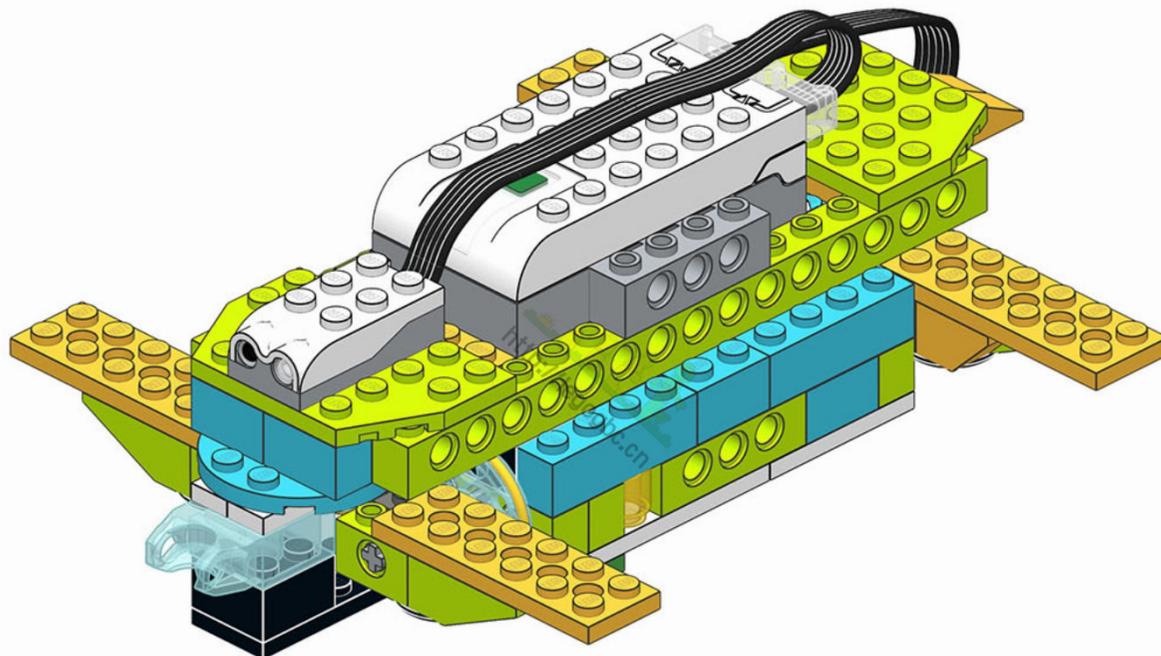
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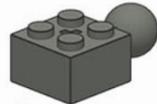
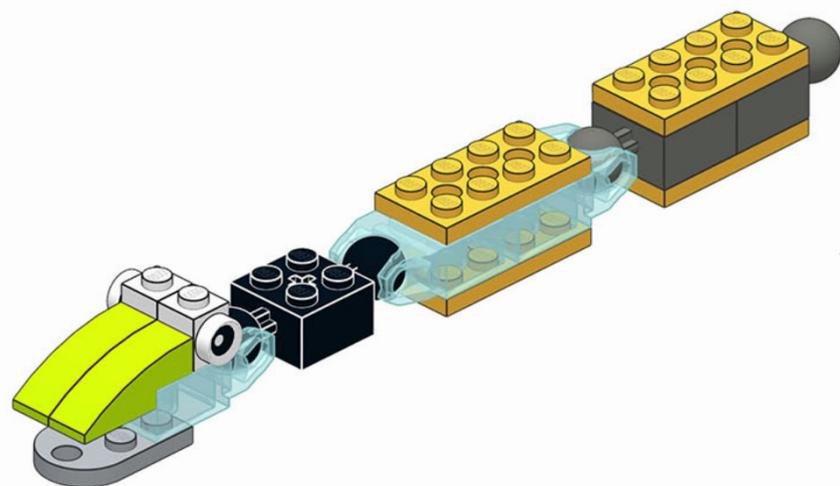
关注公众号获取更多

60





关注公众号获取更多



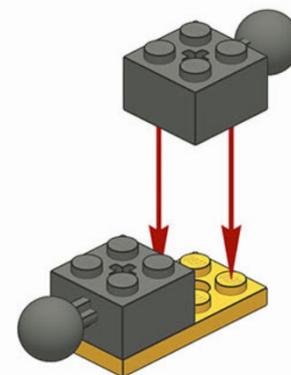
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1x

61

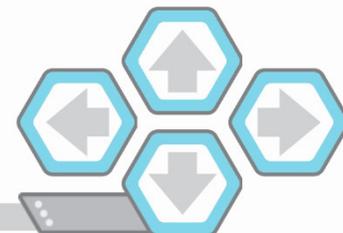
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3

90



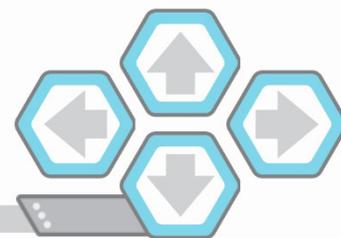
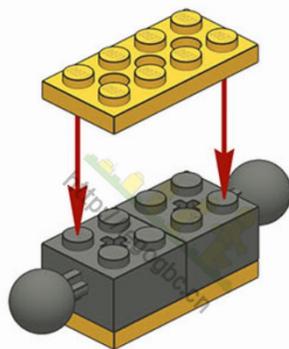


关注公众号获取更多



1x

62

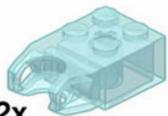




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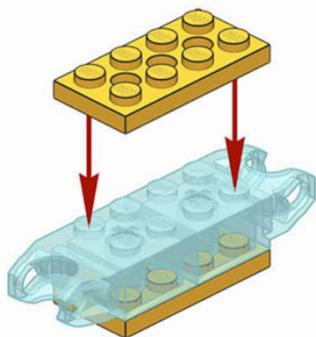


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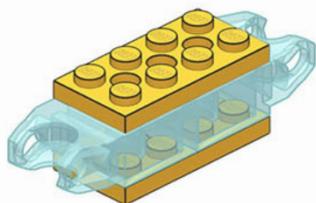


2x

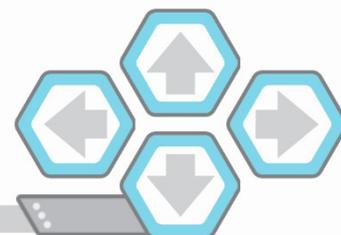
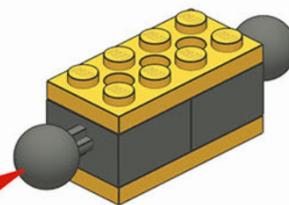
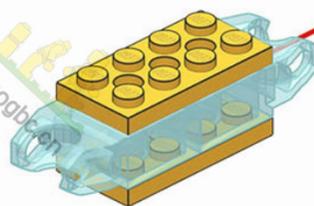
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2

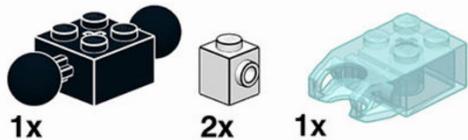


<http://legoblog.cn>





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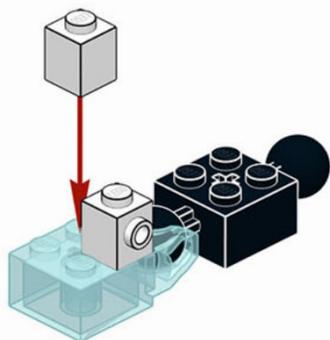


1x

2x

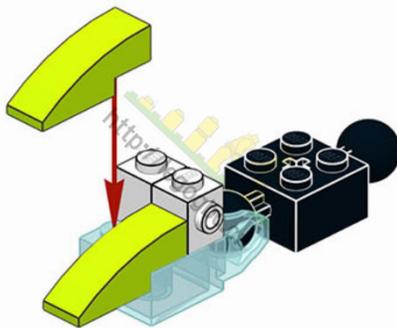
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1



2x

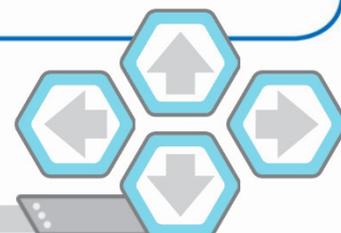
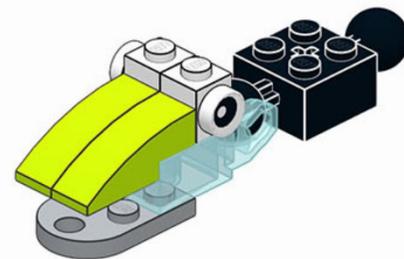
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1x

2x

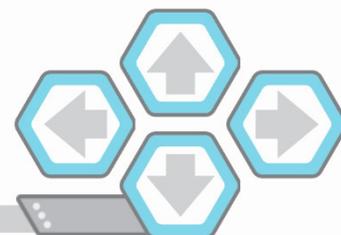
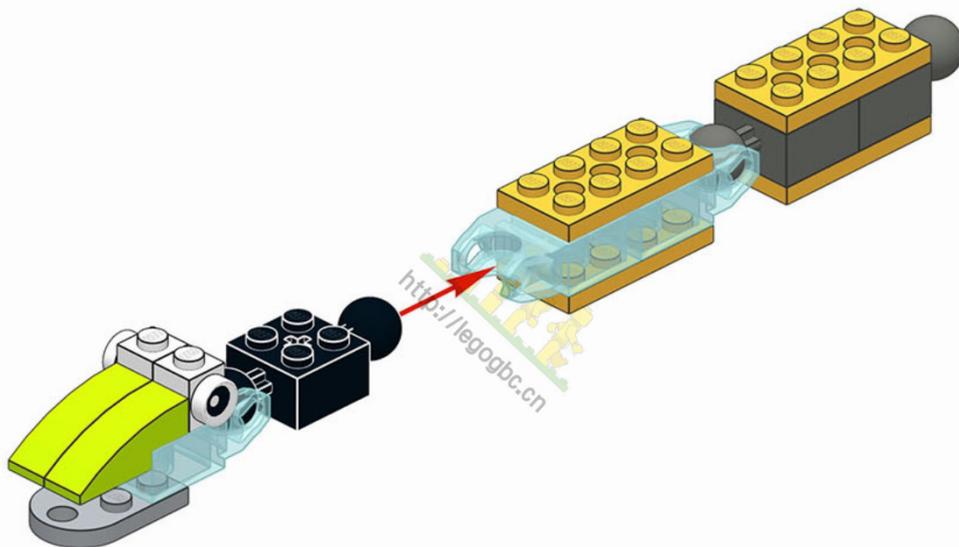
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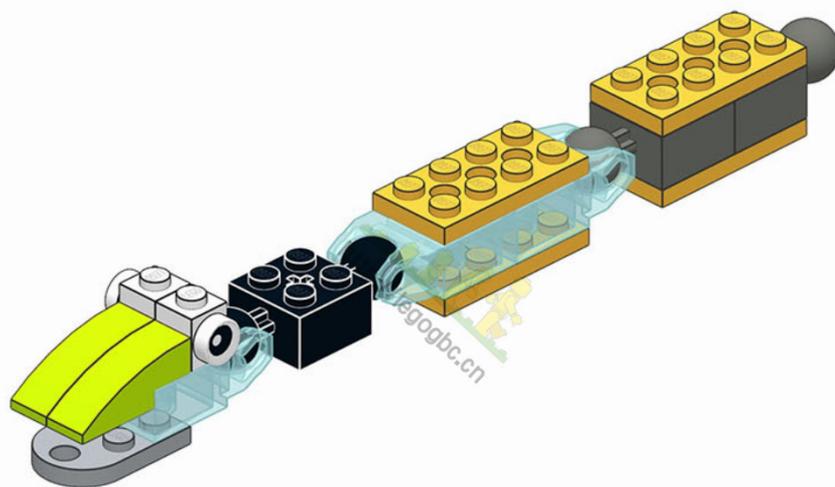
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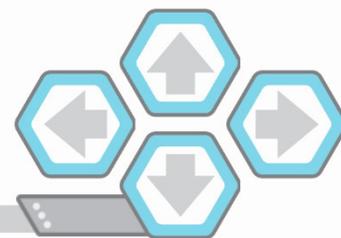


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66



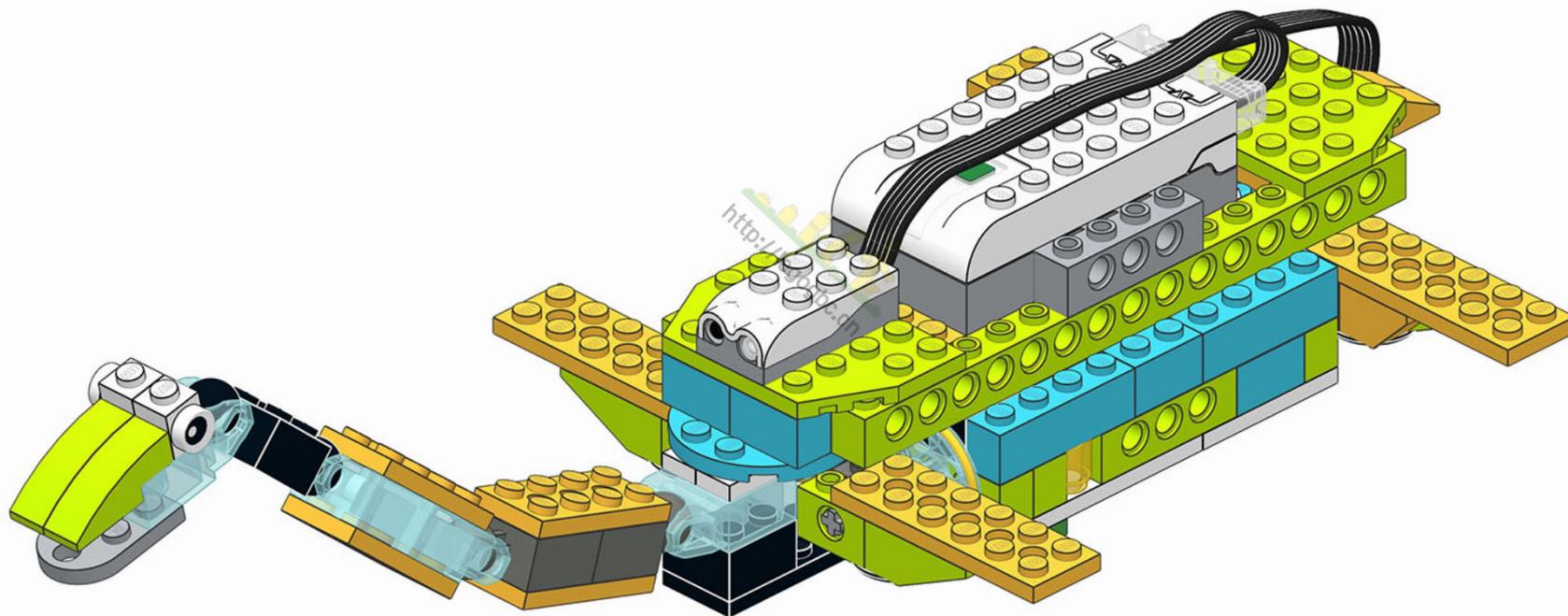
legoabc.cn



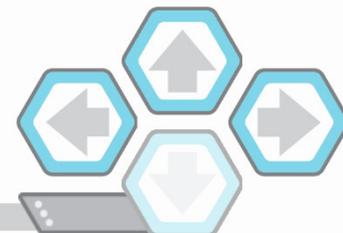


关注公众号获取更多

67



<http://www.lego.com>



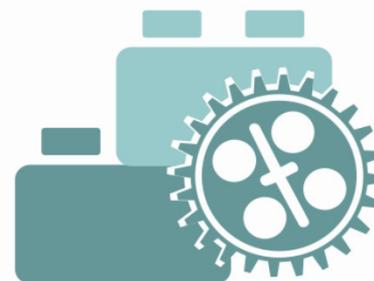


Enhanced version



关注公众号获取更多

Add the decorative elements on the trunk and robot flippers.



Plesiosaurus



3

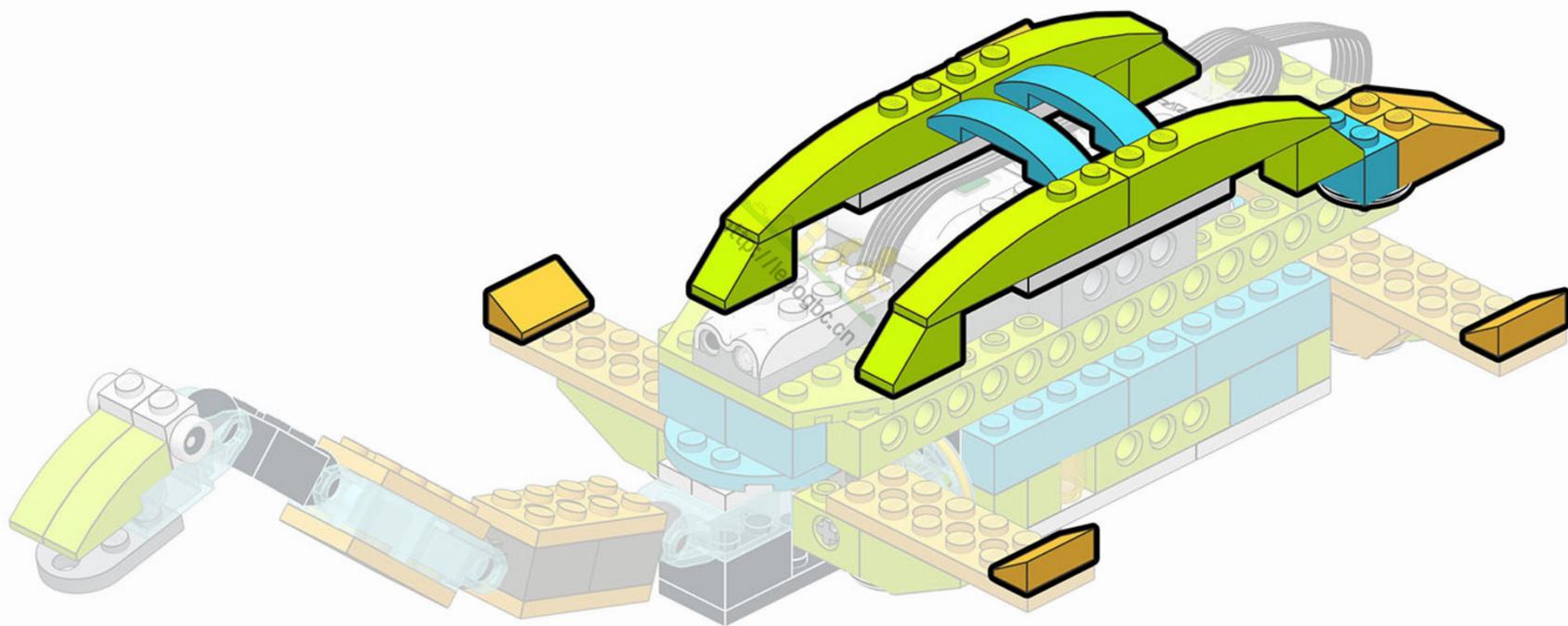


97





关注公众号获取更多



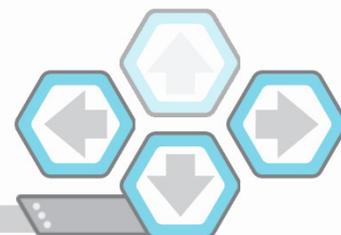
1/8



3

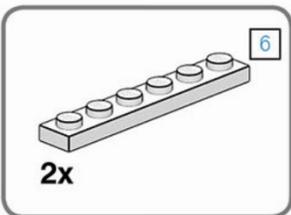


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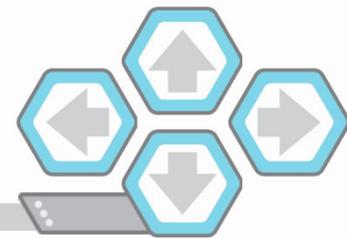
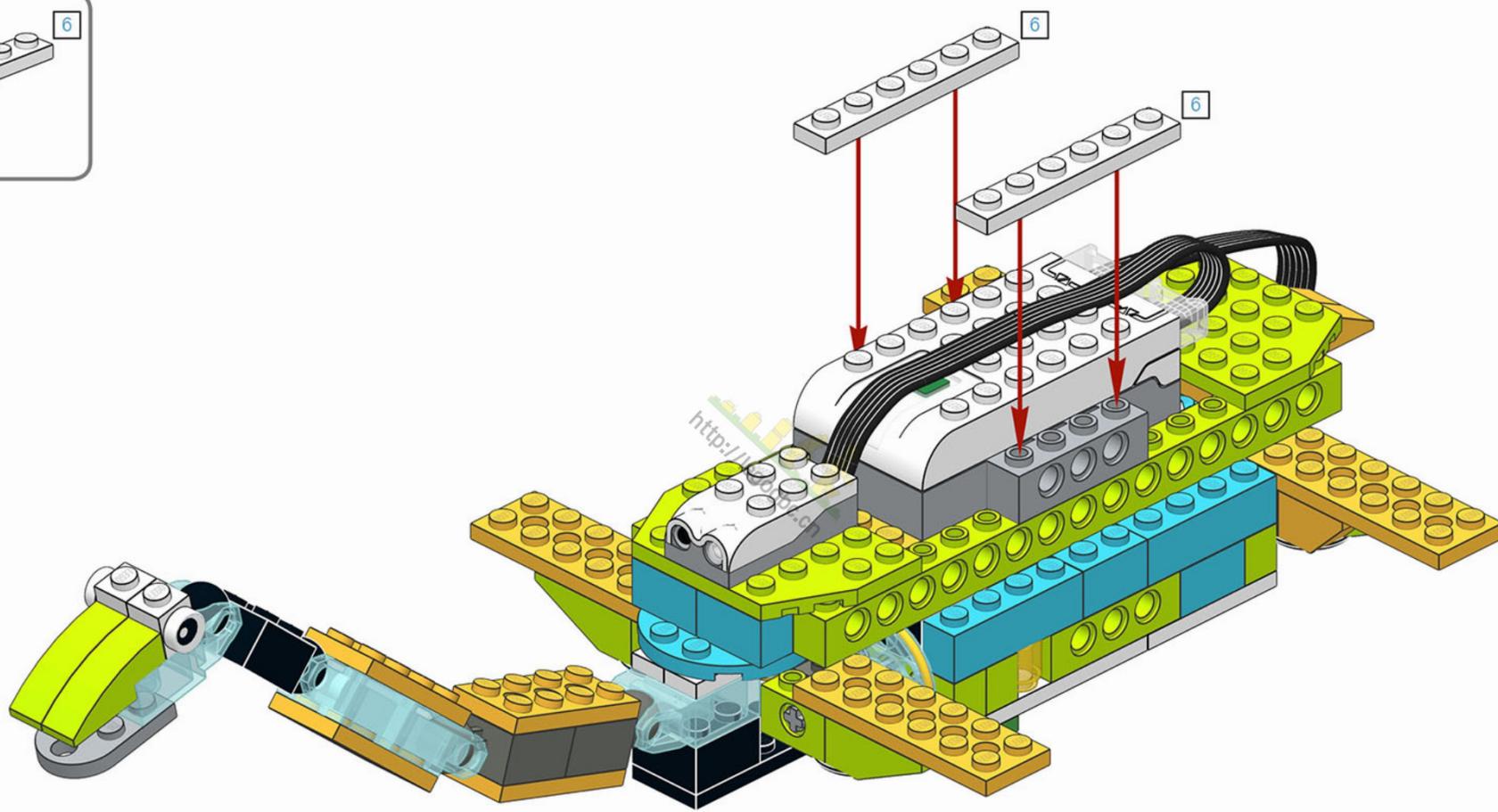




关注公众号获取更多



68



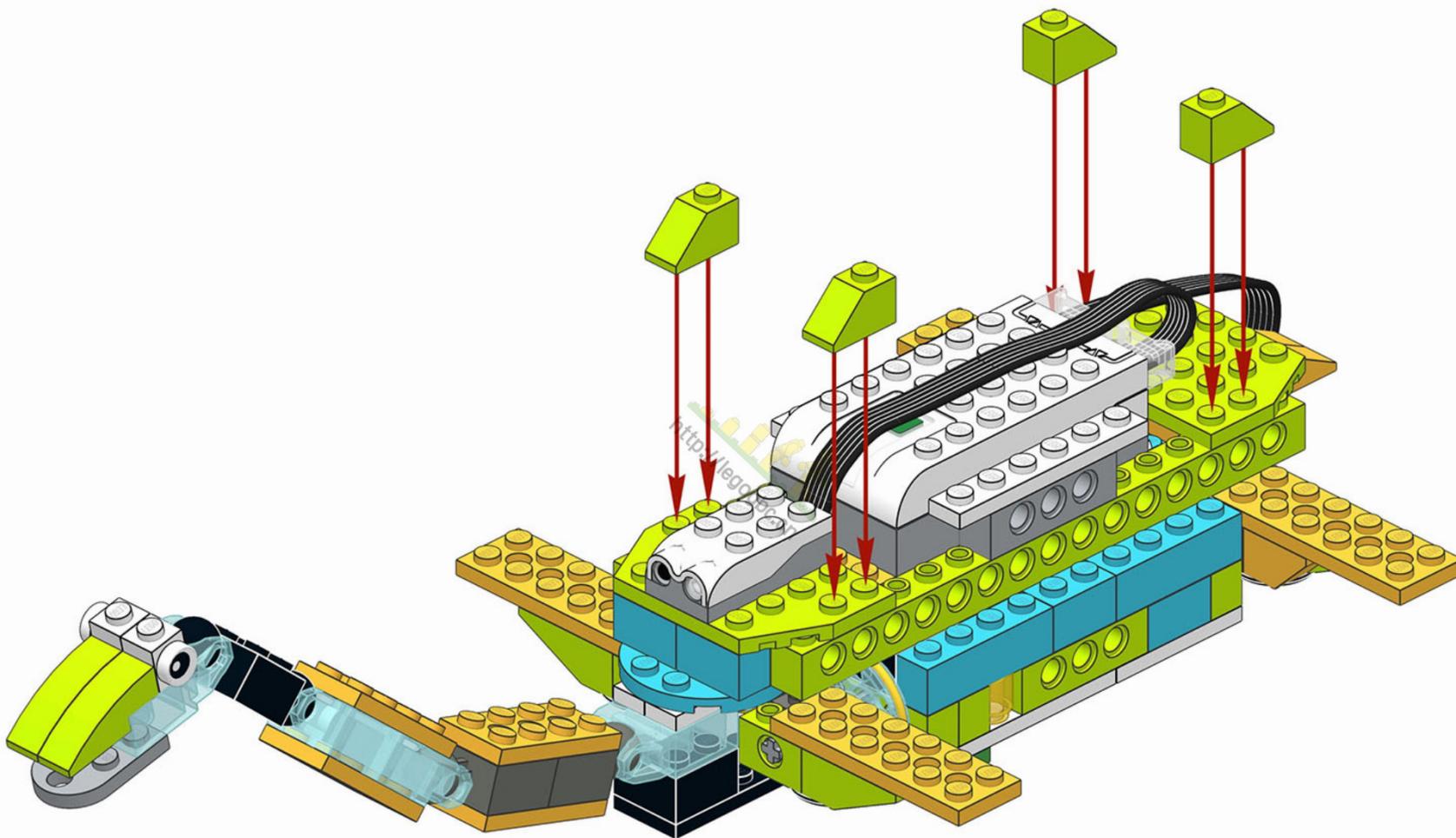


关注公众号获取更多



4x

69



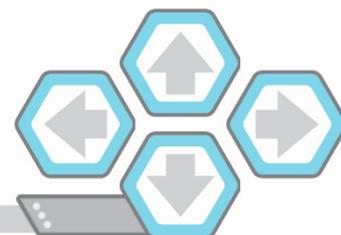
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3

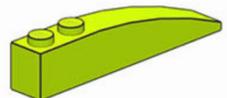


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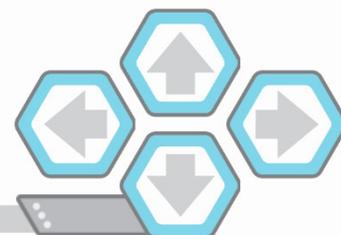
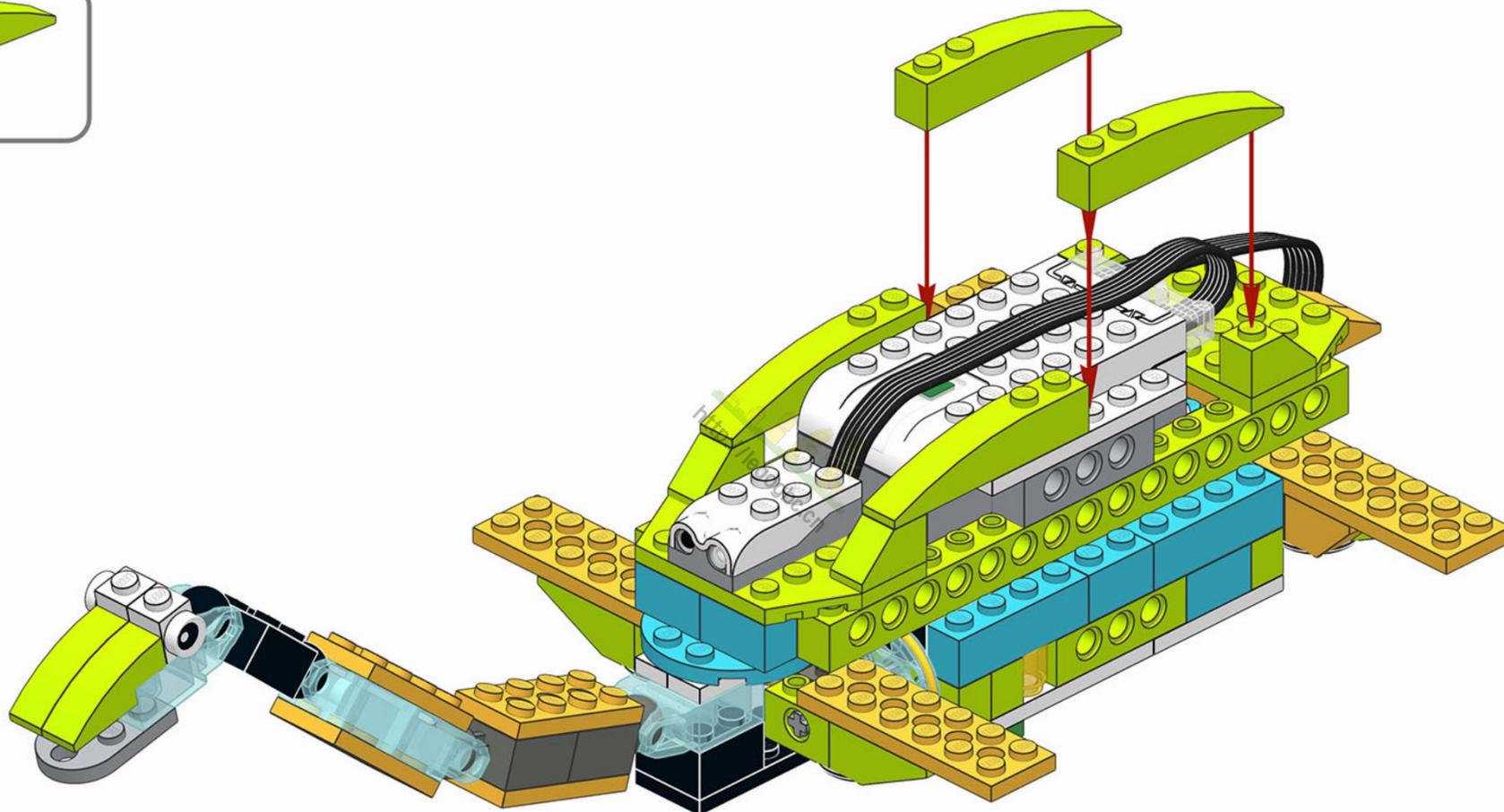


关注公众号获取更多



4x

70



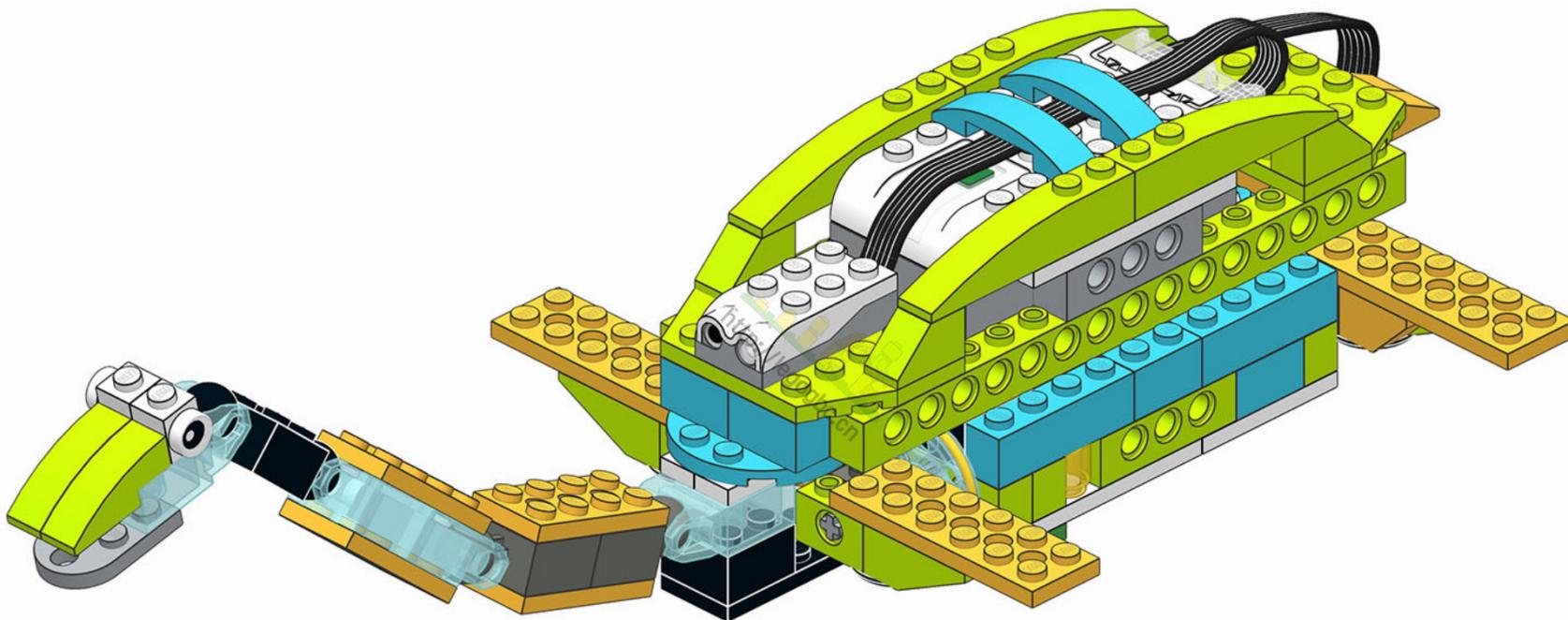


关注公众号获取更多



2x

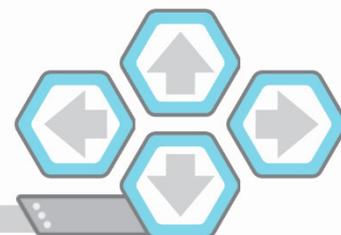
71



5/8

3

102



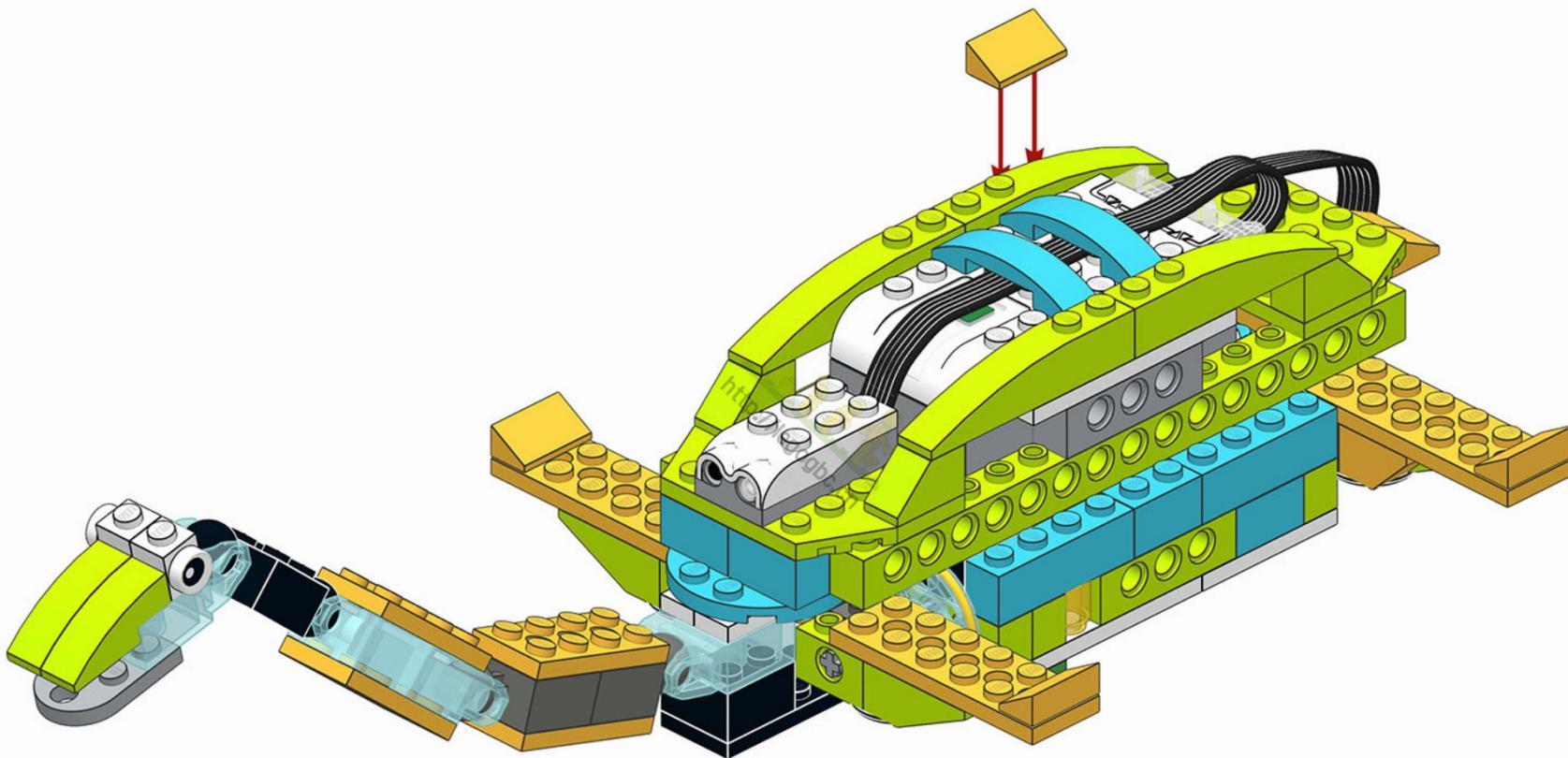


关注公众号获取更多



4x

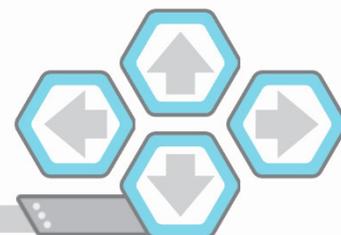
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6/8

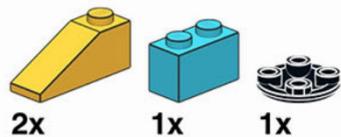
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103





关注公众号获取更多

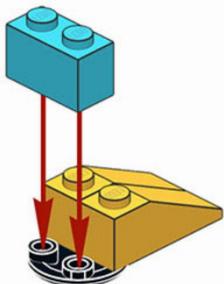


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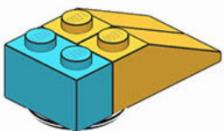
1x

1x

1



2



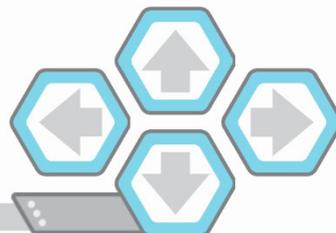
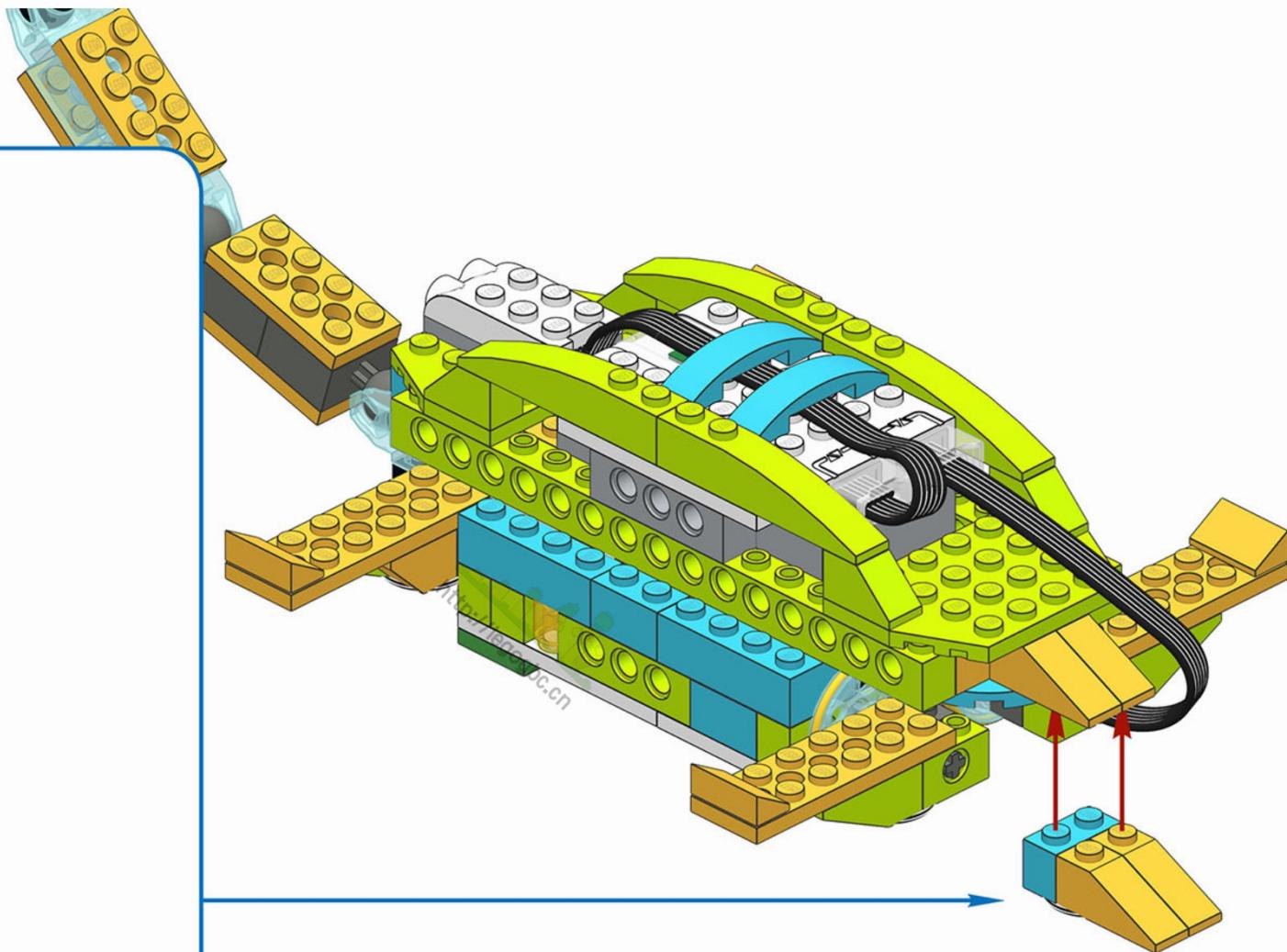
7/8



3



104

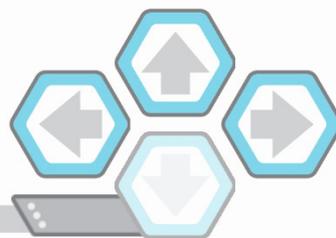
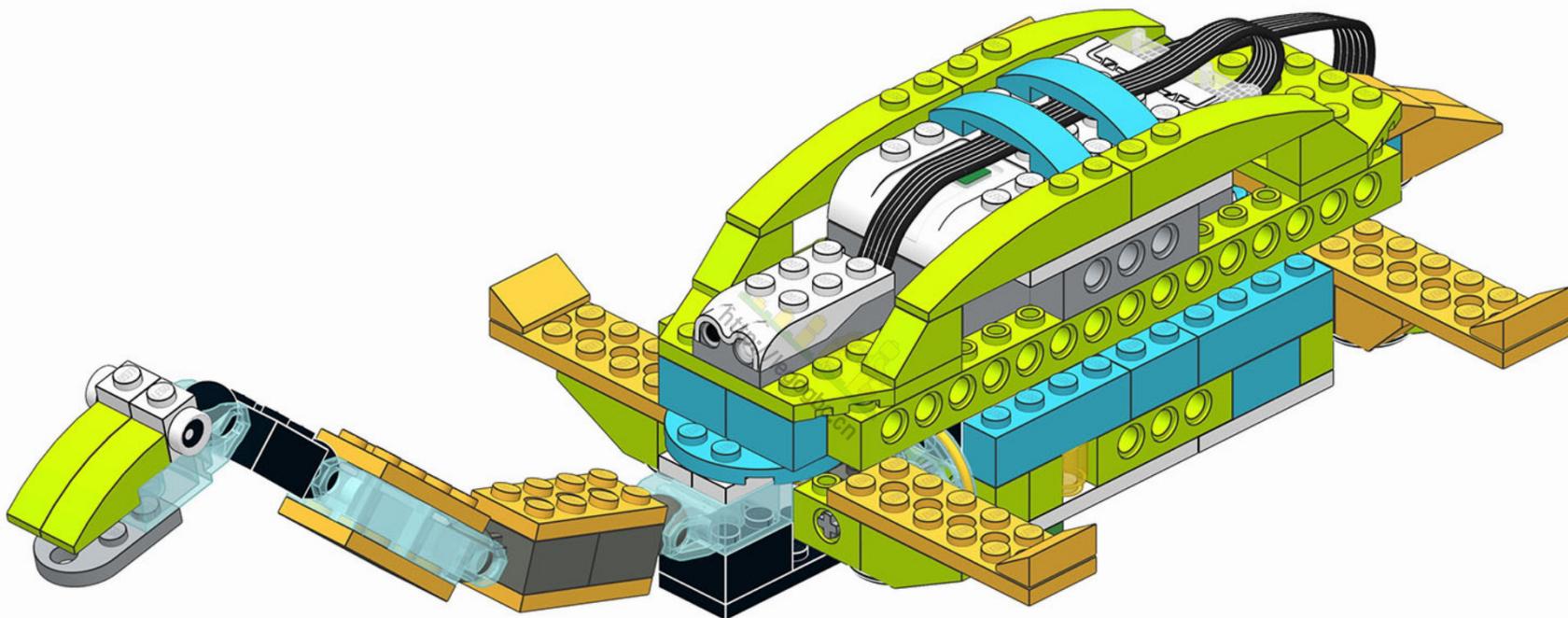




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74





Check it out!



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Avoid any friction
between the cables
while robot is moving.



3



106



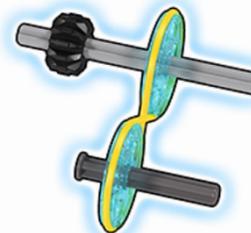
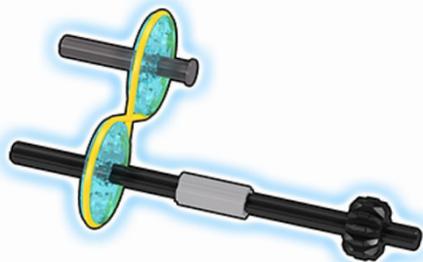
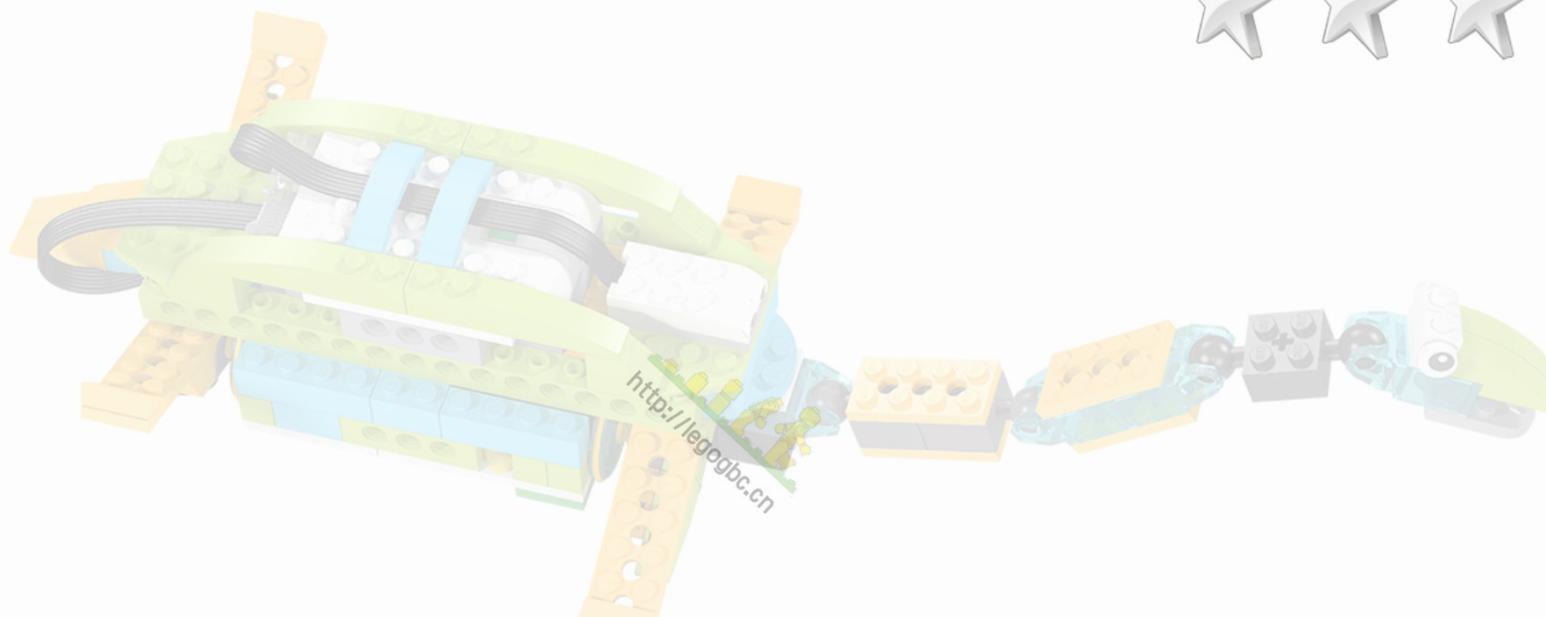


Task



关注公众号获取更多

Place parts of the robot on the right places



3

107



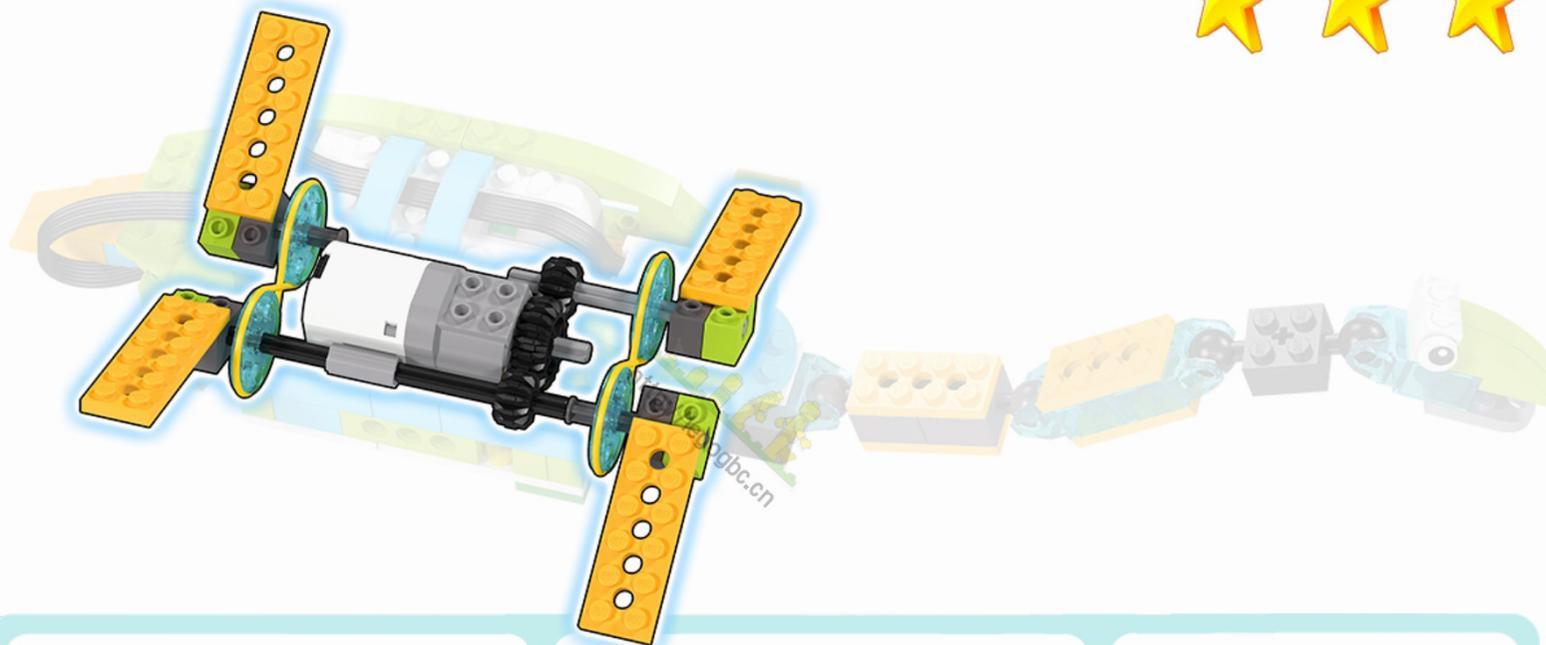


Task



关注公众号获取更多

Place parts of the robot on the right places



6



107



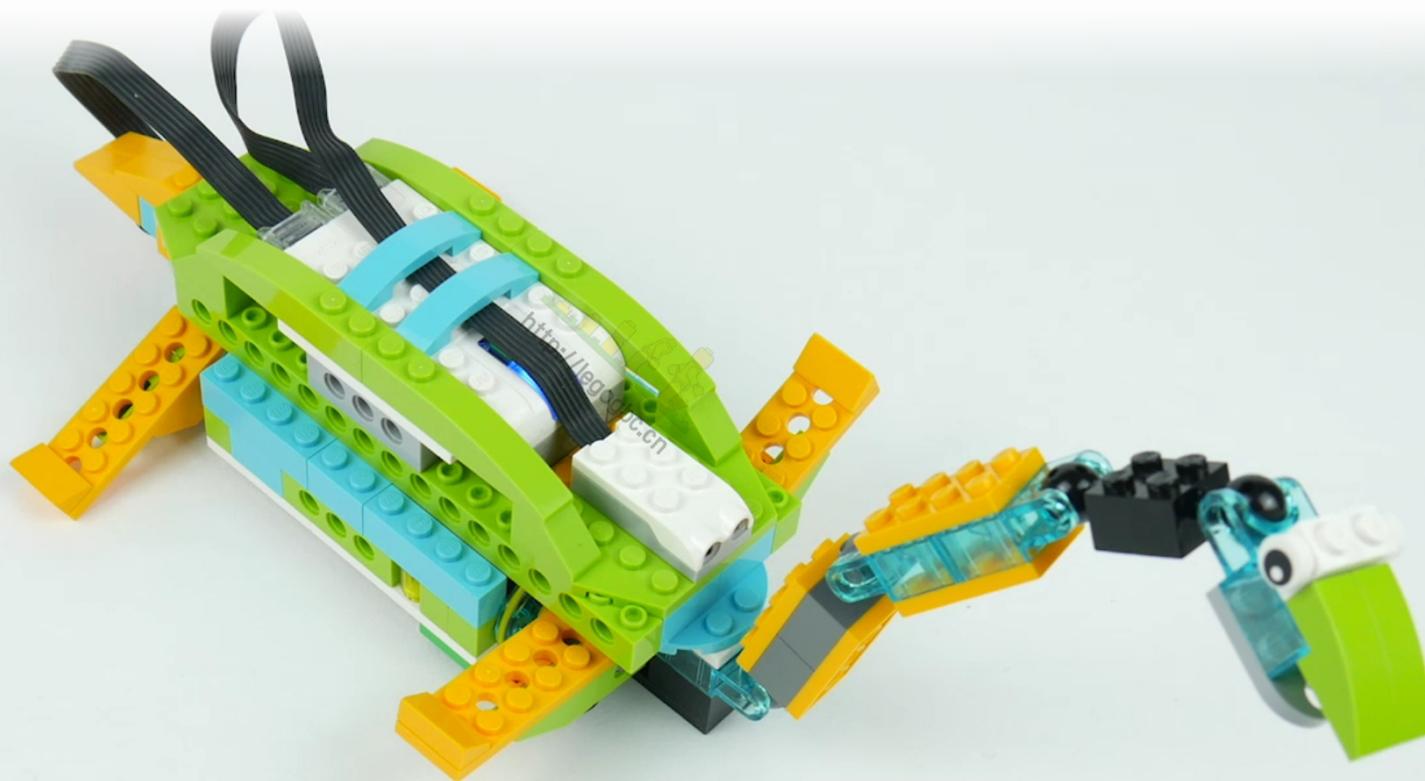


Task 1



关注公众号获取更多

Test the work of the mechanism. Write a program for robot swimming.



robotiseit.com



6



108





Task 1. Algorithm

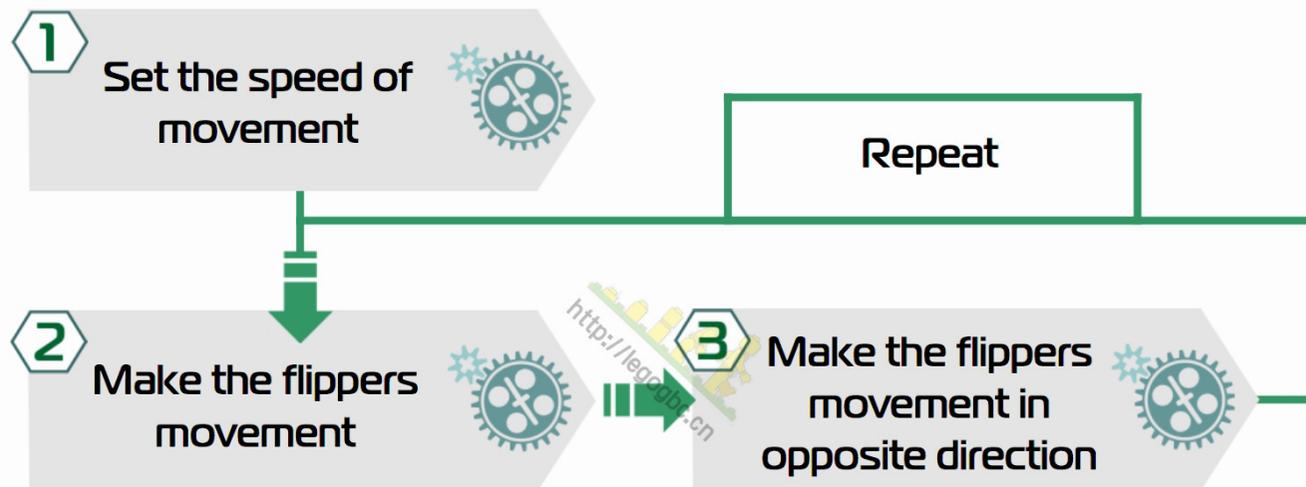


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- 多庆屋中文官方商城目前售价2958日元
下单用码“UPLANTKY”立减800日元



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The program is run by the following algorithm:



6



109



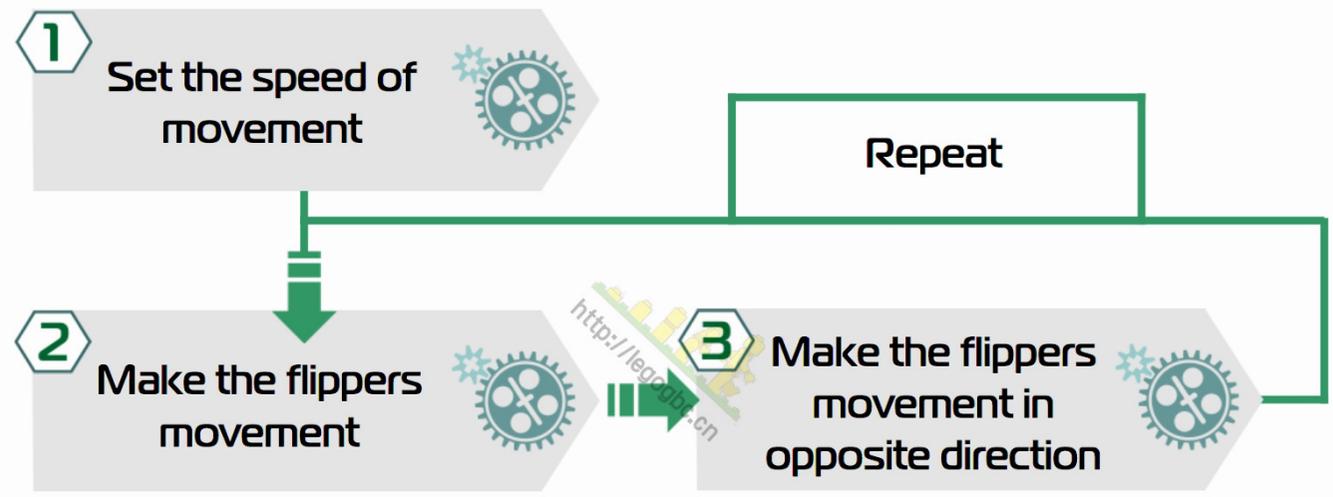


Task 1. Algorithm



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The program is run by the following algorithm:



6

109



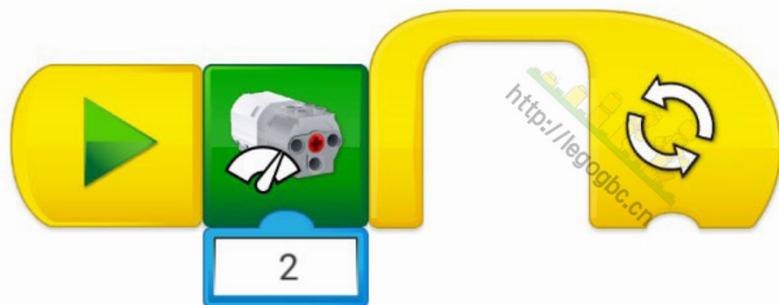
Task 1. Program



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1

Set the speed
of movement



Step:



110





Task 1. Program



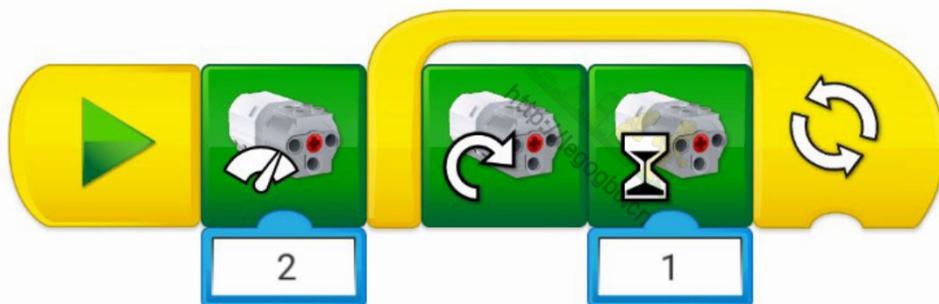
关注公众号获取更多

1

Set the
of move

2

Make the flippers
movement



Step:



6



110



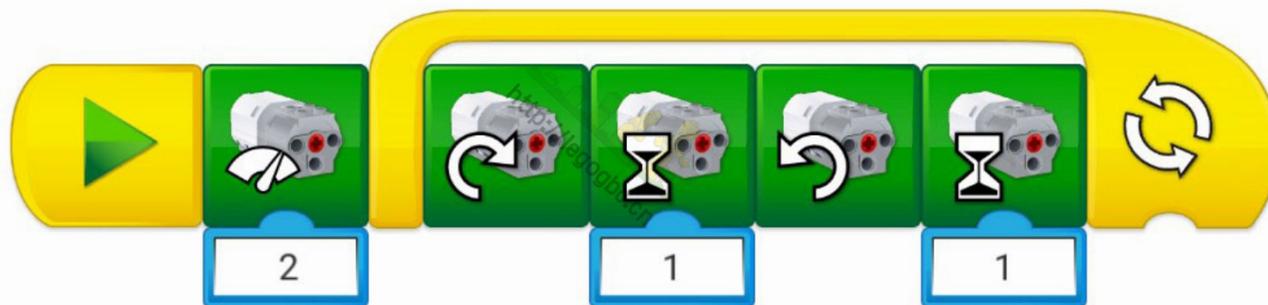


Task 1. Program



关注公众号获取更多

- 1 Set the speed of movement
- 2 Make the movement
- 3 Make the flippers movement in opposite direction



Step:



110



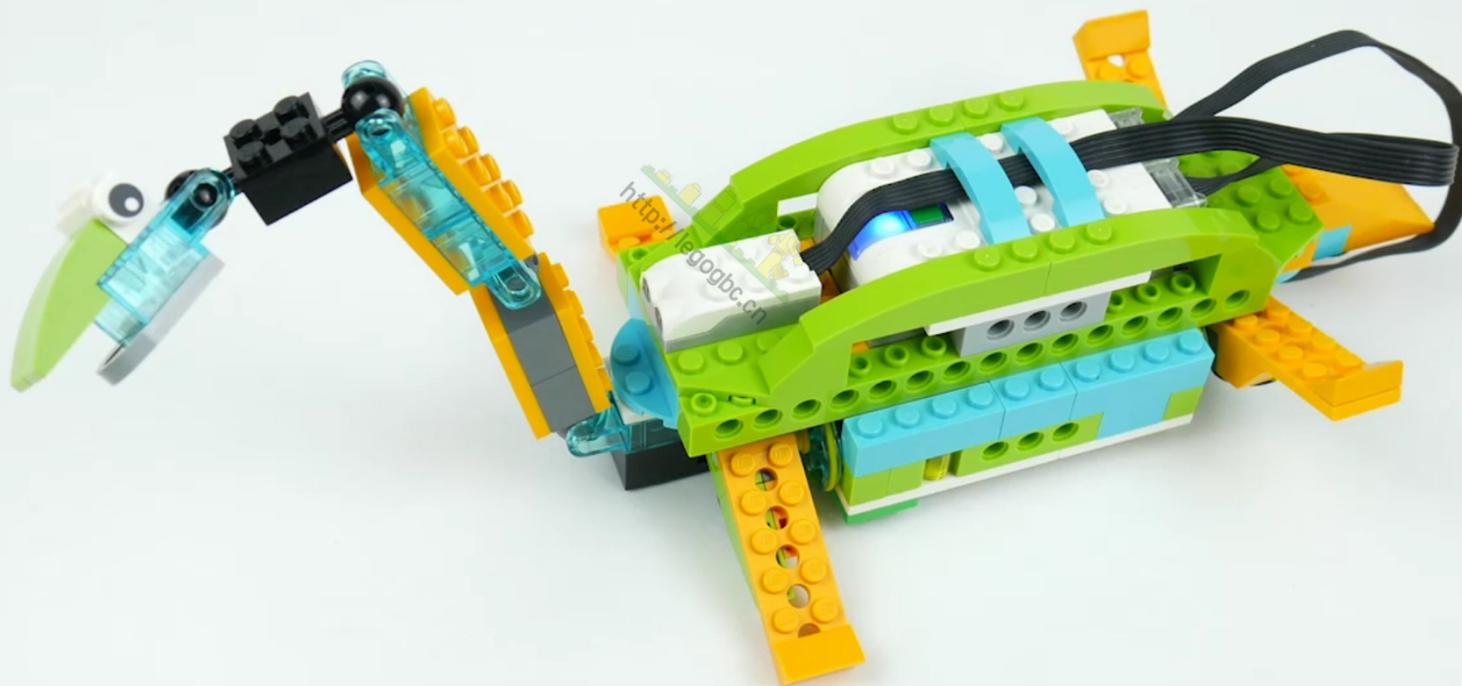


Task 2



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Program a change in the frequency of the flippers movement depending on the position of the robot neck. If the neck is high, the robot should swim slower, and if is low - the robot should swim faster.



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6



111





Task 2

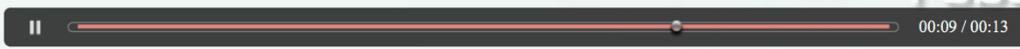


关注公众号获取更多

Program a change in the frequency of the flippers movement depending on the position of the robot neck. If the neck is high, the robot should swim slower, and if is low - the robot should swim faster.



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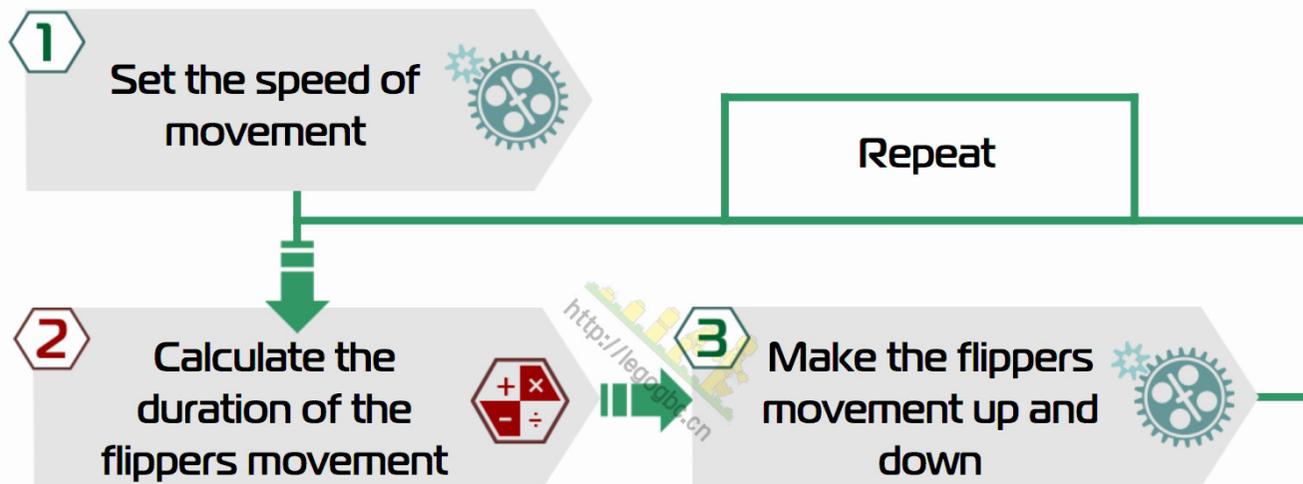


Task 2. Algorithm



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The program is run by the following algorithm:



We have to program the robot so that the longer distance is detected, the less time the robot flippers movement were. This can be done if the maximum distance that the sensor can "see" to take away the current sensor data. And in order for the movement to be more active, we will further reduce the duration of flippers movement by dividing the result by 10.





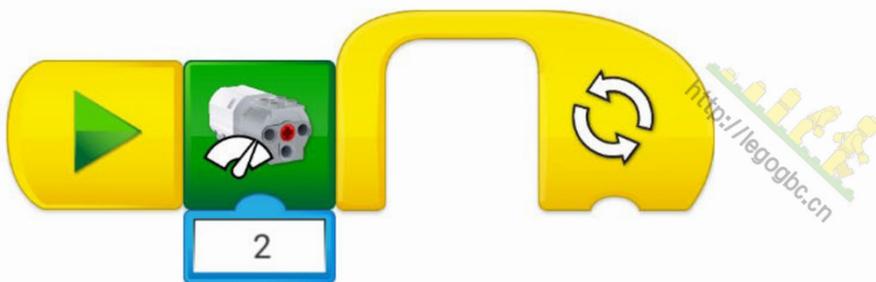
Task 2. Program



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1

Set the speed
of movement



Step:



6



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Task 2. Program



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1

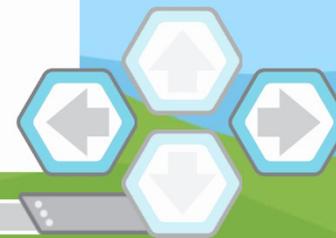
Set the
of move

2

Calculate the
duration of the
flippers movement



Step:





Task 2. Program



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- 1 Set the duration of movement
- 2 Calculate the duration of movement of the flippers
- 3 Make the flippers move up and down



Step:





Discuss!



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- ▶ How do robot flippers move?
- ▶ Are there any delays in the movement? If so, what caused them?



6



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Time for calculations



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Delays between cycles of flippers movements can be caused by long-term calculations. In the program you wrote, the calculation the duration of the motor rotation is initially calculated, and then the start of the motors. Because of this, there are pauses between cycles.





Task 3



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In order to avoid delays between the cycles, it is necessary to make calculations in a separate program that works in parallel:



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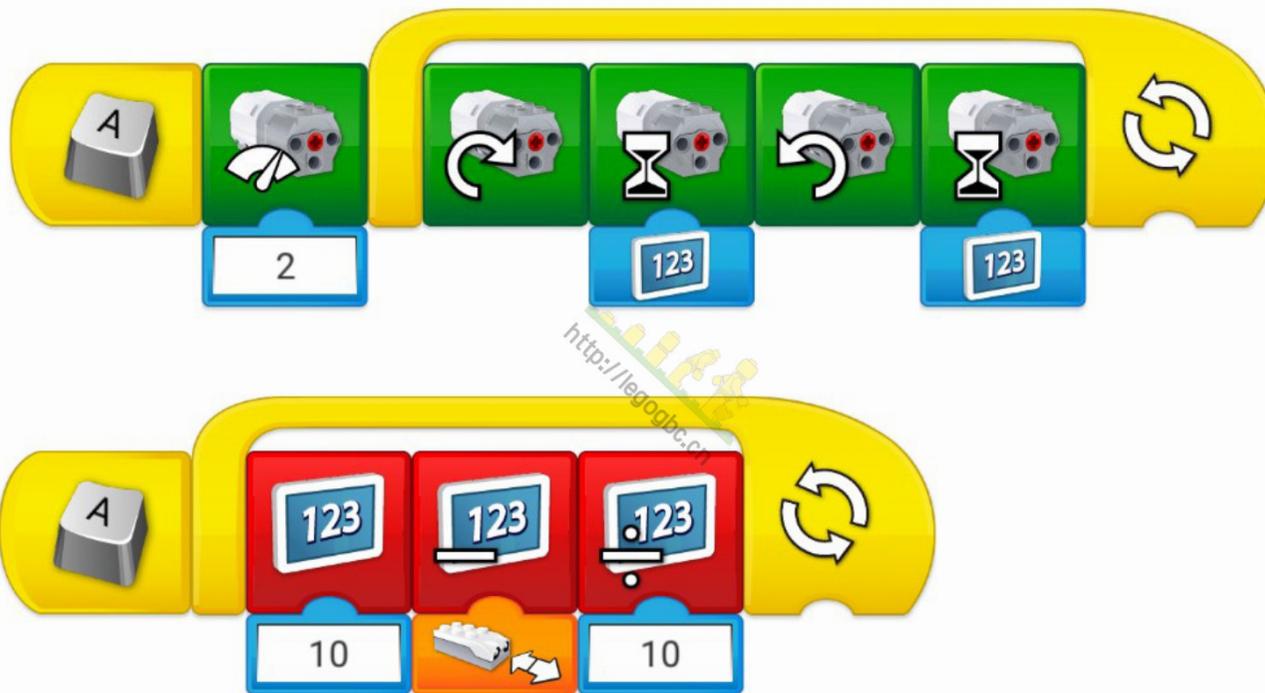


Task 3. Program



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Modify the program you have written as follows:



Thanks to the launch of the button, these two programs will start work at the same time and will almost never affect the work of each other.



6



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Task 3. Questions



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What program blocks do the mathematical actions required to calculate the duration of the flippers movement?





Task 4 *



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Program the color change of the smarthub backlight by changing the distance detected by the motion sensor. So you can clearly see the changes in distance.



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6



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Task 4 *. Program



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Add in the calculation cycle the color change of the smarthub:





Who is faster



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The remains of Plesiosaurus indicate that they became a prey of the Predator-X. Scientists estimated that the Predator-X could sail up to 5 meters in one flippers movement, and it made about one flippers movement for a second. Let's calculate the speed of the reptiles and find out if Predator-X could catch up the Plesiosaurus!



4 meters for one movement
? movements for the second



5 meters for one movement
1 movement for the second



6



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Who is faster



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In order to find out the Predator's X speed, multiply the distance what it swims in one flippers movement to the frequency of flippers movements:

$$\begin{array}{l} \text{5 meters for} \\ \text{one movement} \end{array} \times \begin{array}{l} \text{1 movement for} \\ \text{the second} \end{array} = \begin{array}{l} \text{5 meters for one} \\ \text{second} \end{array}$$



6



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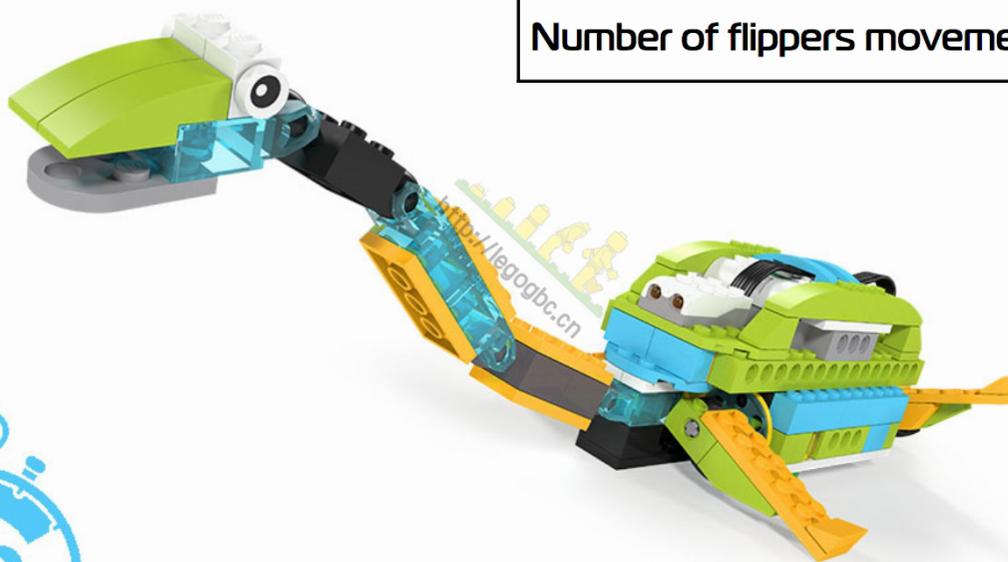
Task 5 *



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Count and write to the table the maximum number of flippers movements that Plesiosaurus can do in 10 seconds. What position should robot neck put on?

	10 s	1 s
Number of flippers movement	?	





Task 6 *



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Calculate and record in the table how many flippers movements Plesiosaurus makes in one second at maximum speed. To do this, divide the value in the first column by 10.



	10 s	1 s
Number of flippers movement		?



6



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Task 7 *



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Plesiosaurus swims 4 meters in one flippers movement. Multiply 4 meters by the number of movements that the robot makes in 1 second and you will know the speed of the robot. Write the result to the table:



Maximum speed, m / s	?
----------------------	---





Discuss!



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Could Plesiosaurus escape from such a Predator- X? Who could swim faster?



<http://legogbc.cn>



6



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Question



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How many flippers did Plesiosaurus have?



Two

Four

Six

6

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Question



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Are there any sea creatures that swim the same way as Plesiosaurus?



No, there aren't

Yes, there is another species that swims the same way

Yes, such movement is common



6

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Discuss!



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- ▶ What did Plesiosaurus eat?
- ▶ What forms of the Plesiosaurus body existed?



- ▶ How did Plesiosaurus move the flippers to safely swim?
- ▶ What is the difference between Plesiosaurus and Ichthyosaurs?



6



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