



MY ROBOT TIME

MRT3 Series

- MRT3 curriculum is developing for helping students(age 6 - 13+), through robotics, learn essential STEM (science, technology, engineering, and math) concepts.
- Step by step and systematic building instructions for MRT3 educational robot kits.

**Intermediate
Level**

**1
Foundation
Level**

**2
Beginner
Level**

**4
Advanced
Level**

MRT3-3. Intermediate Level

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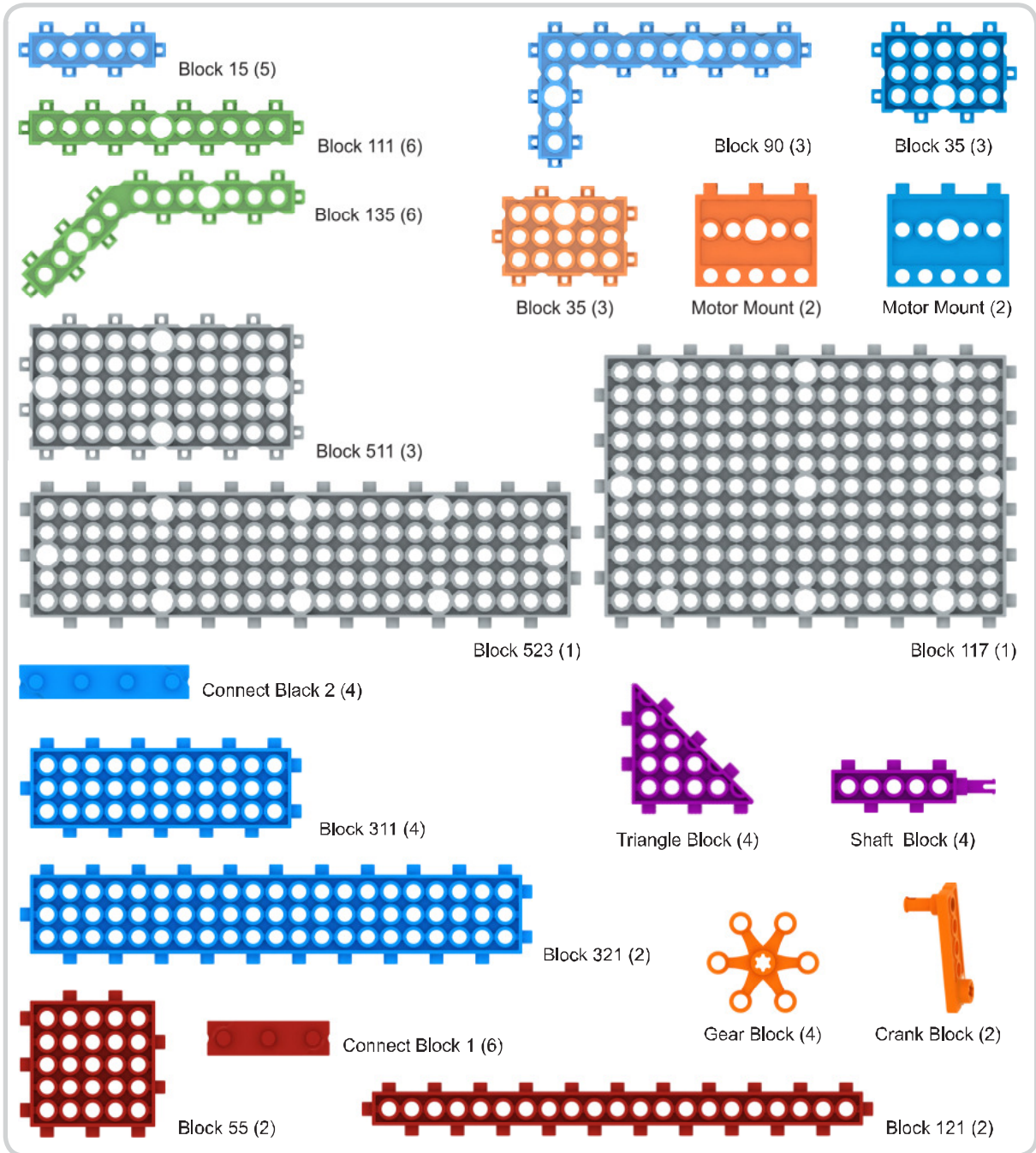
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Part list

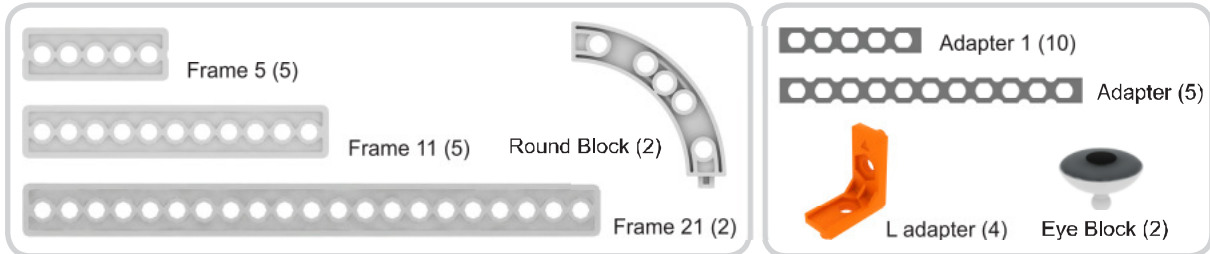
Block

※ The form and color of some parts may be different when compared to actual parts due to continues improvement of production quality.

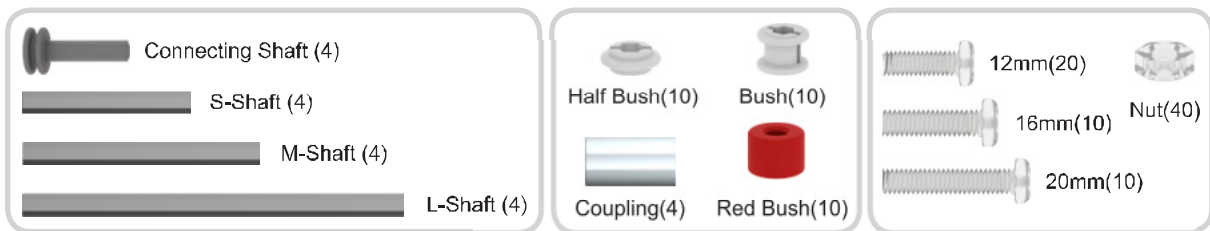


Intermediate Level

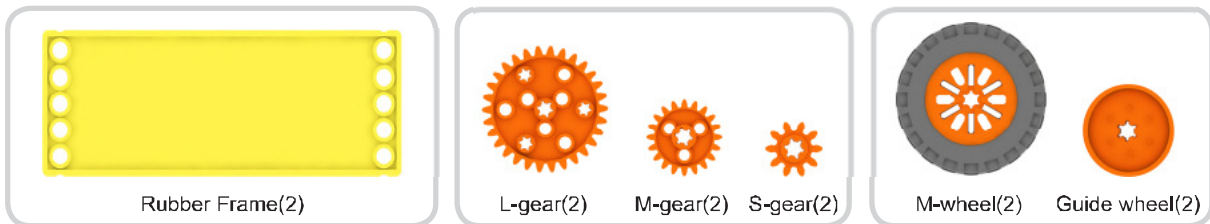
Frame / Adapter



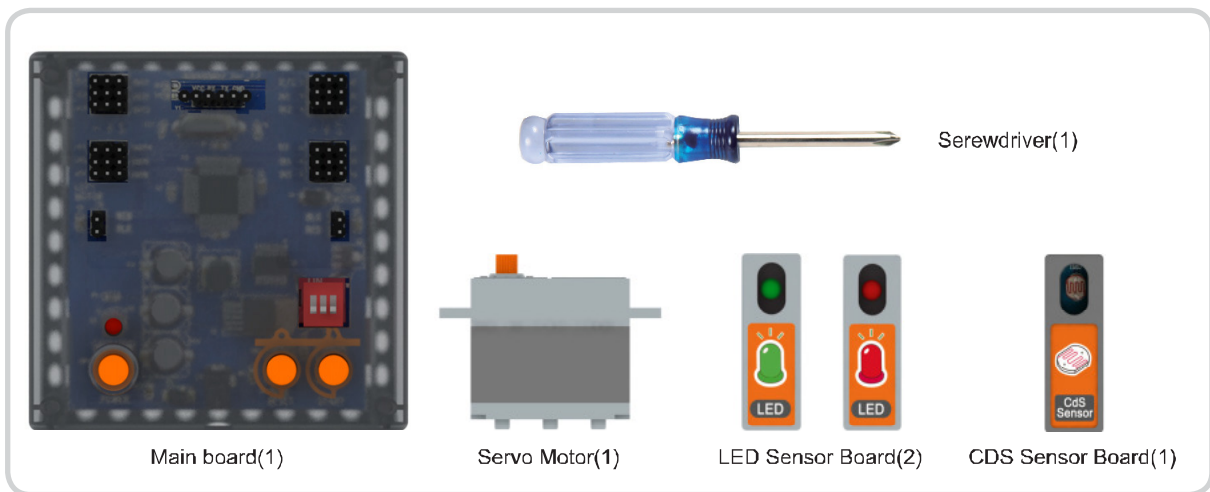
Shaft / Bush



Gear / Wheel



Electronic Parts



T Technology **How to use the electronic parts?**

Mainboard assembly/Funcion of each feature

OUT-PUT connector

The result is processed and written by the program and sent to a LED, Buzzer or a servo motor.

Download connector

After your program is downloaded from your PC to this port, your robot will move as you programmed.

IN-PUT connector

This part receives input value by connecting with switches and various sensors here.

MCU IC is responsible for the saving and running program. (Acts in the role of the brain.)

Right DC Motor connector The output that coordinates the functions of the right motor.

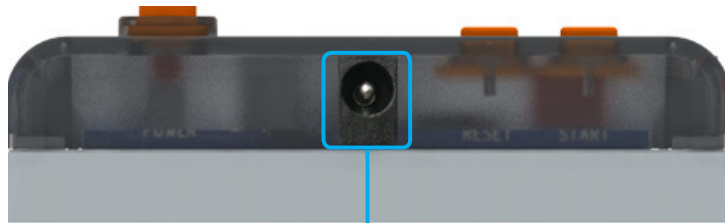
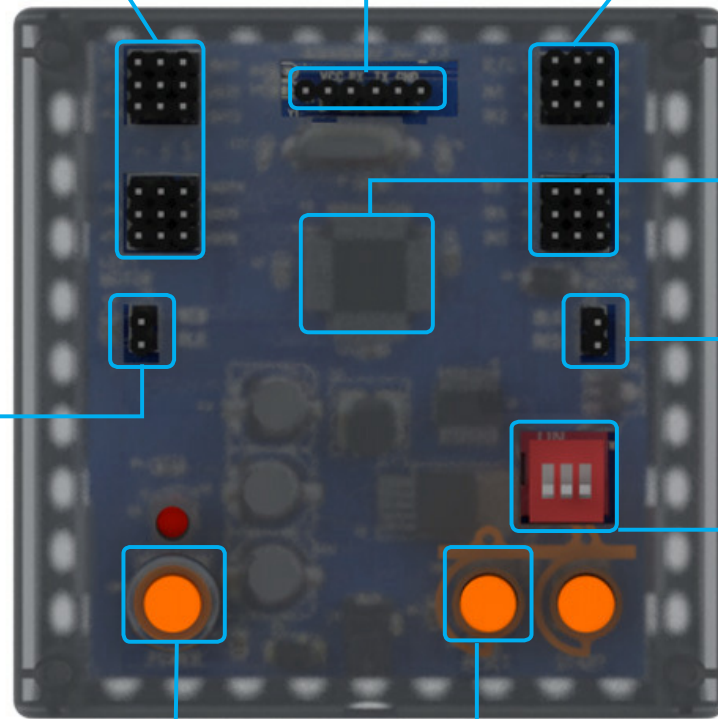
Modifying Remote Control ID Switch This part is for setting remote control ID.

MODE Settings Modify modes of program.

Left DC Motor connect

The output coordinates the functions of the left motor.

Power Switch Power on/off switch.



Power Connector Connects to the 6V battery packs.

LED Sensor



"Send" light

An infrared signal is sent to the object. If there is a reflection, the information is sent to the 'receive' light part.

CDS Sensor

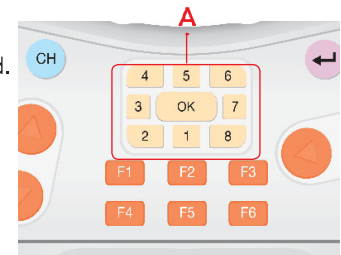


Light Sensor

Light is received and affects the behavior of the sensor.

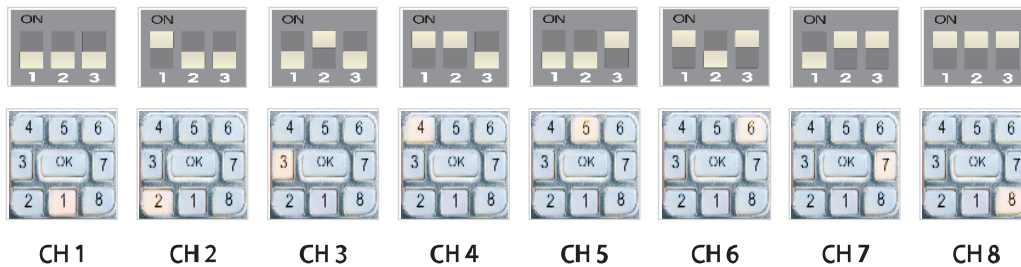
Setting remote control ID

- ① Turn on the robot.
 - ② Connect RC receiver board to R/C connector.
 - ③ Press **CH** button while holding **←** button. The **A** panel ID LED turns on and shows you what mode you chose.
 - ④ Press **CH** button while holding **←** button and choose your ID. (Number 1~8)
 - ⑤ After selecting ID, if you release **←** Button and press **CH** button, ID will be selected.
 - ⑥ The LED on the mainboard will blink 3 times and it will turn off automatically.
That means the ID Selection is finished.
 - ⑦ If you press **←** button, you can see your selected ID.
- ※ If there is a problem, repeat steps 1-7 carefully.

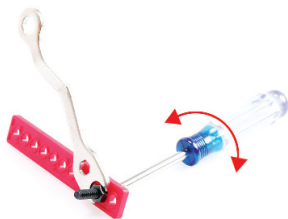


How to set up communication ID

- ※ The maximum number of channels can be set as shown below without interference.
Use the picture to assign the channels to the communication ID.



How to use a screwdriver and a spanner?



1. When holding a screwdriver; Turn right to tighten and turn left to loosen.
2. When tightening or loosening a bolt, hold it firmly to keep the nut in place.



Creating an educational model for the basic program

1



Connect servo motor and DC motors to block117, then insert medium gears to the shaft of DC motor.

2



Attach remote control receiver board and various sensors.

3



The mainboard is attached on the top of DC motor.

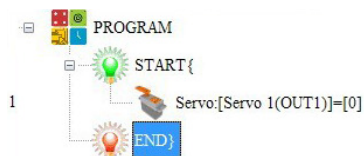
4



Connect battery cases to mainboard.

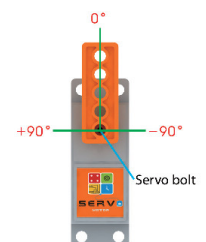
Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.



2. After downloading the program, power off and on again.

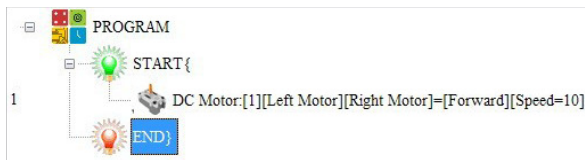
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture.



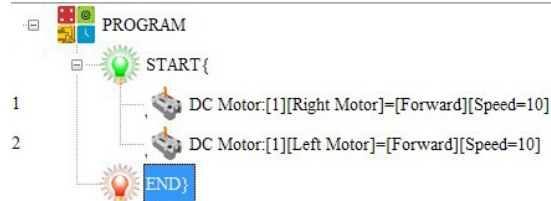
How to operate the DC motor

Left motor and right motor move forward at speed level 10.(Maximum speed)

1.



2.



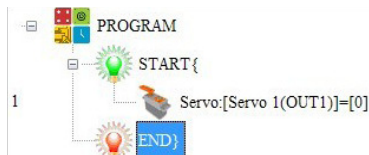
No.1 and No.2 are exactly the same programs. However, program No.1 is used to control the two motors together, and program No.2 is used to control the motors separately. Let's try to change the program to the mainboard in different ways.

How to operate the Servo motor

Servo motor connected to the OUTPUT port 1 is rotated by 90 degrees.



To adjust zero point of the servo motor connected to OUTPUT port 1



Servo motor connected to the OUTPUT port 1 is rotated by -90 degrees.



❖ Let's change the degree of servomotor by modifying the program.

Creating Conditional(IF/END)

1. Creating a conditional sentence for sensor

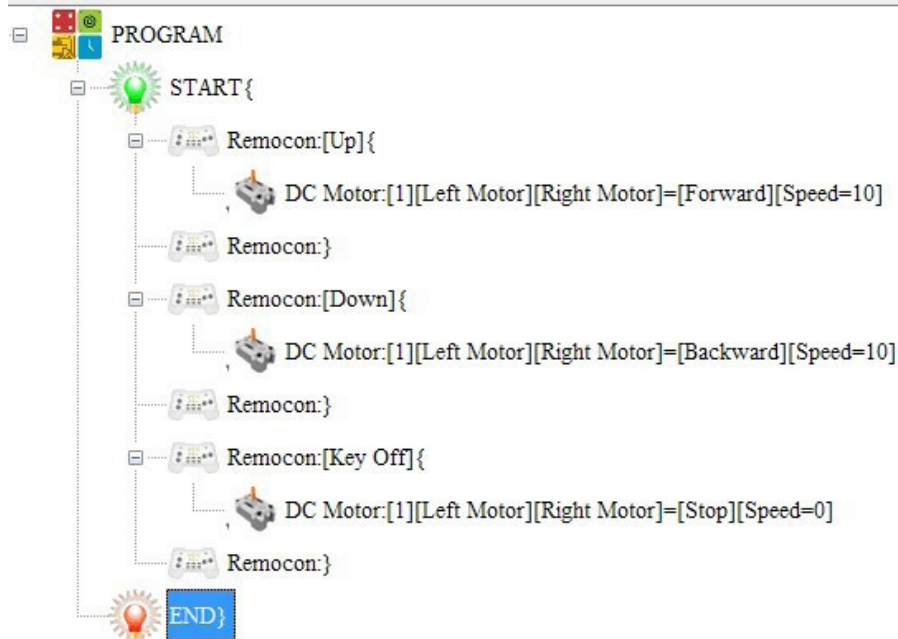
- When pressed touch sensor connected to INPUT port 1, left DC motor will work. When not pressed, the left DC motor will not move.



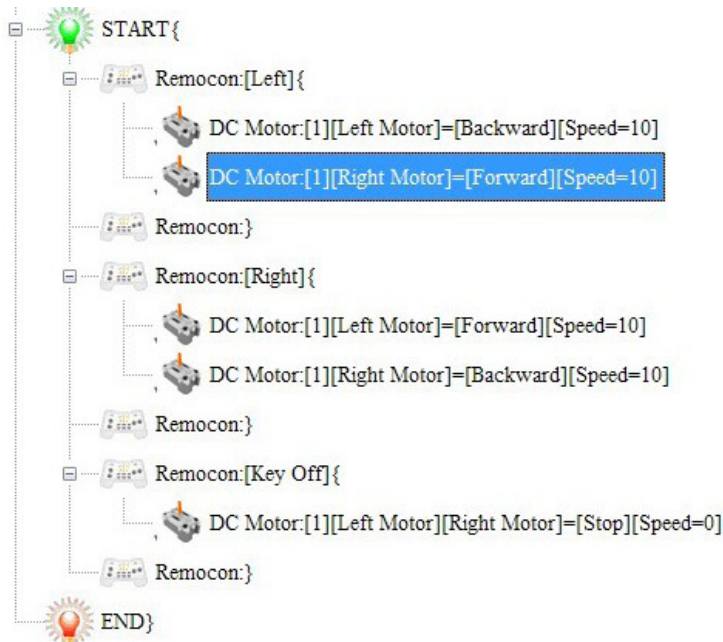
♣ Let's change the program of the Infrared sensor and CdS sensor in the same way.

2. Creating a conditional sentence for remote control

- If one press the directional keys(^ ▽) of the remote control, both DC motors will move back and forth.



- If one press the directional keys (< >) of the remote control, both DC motors will move opposite directions from each other.

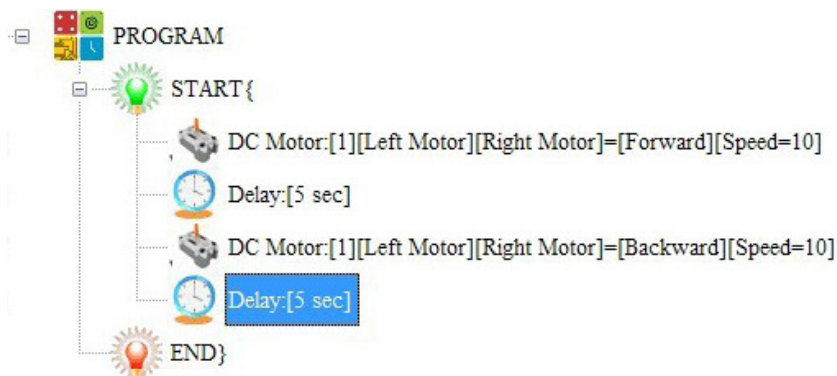


※ **Note: When creating remote control conditional sentences, it is necessary to enter 'KEY OFF' conditional sentence, then the robot will operate smoothly.**

♣ **Let's create various programs by using remote control FUNCTION keys (F1/F2 ~ ~)**

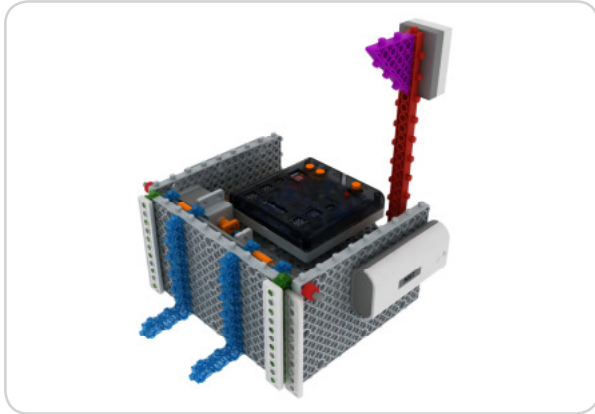
Creating a time delay

- DC motors move forward for 5 seconds , then go into reverse.

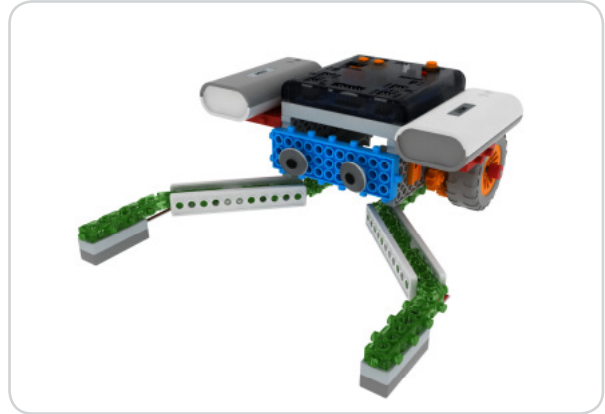




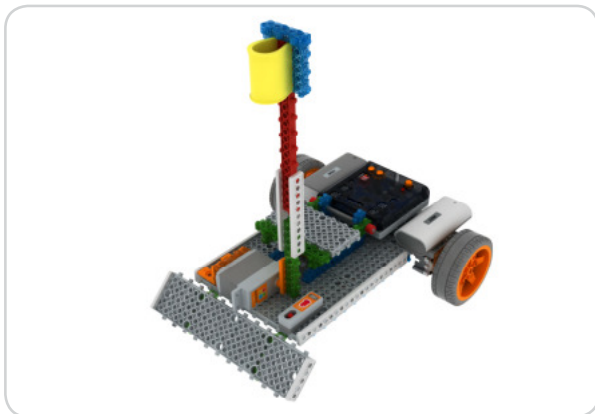
What robots are we going to assemble?



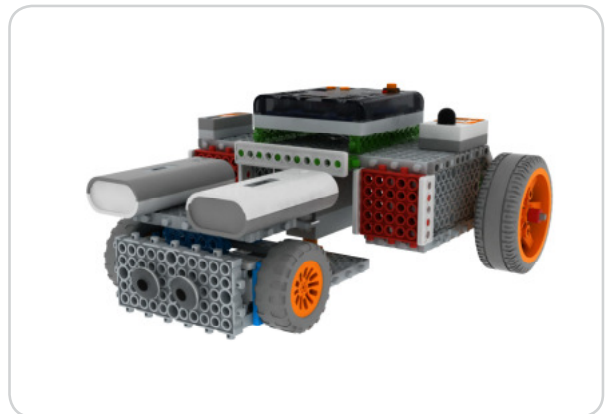
1. Soccer Robot



2. Hemiptera



3. Touch Battle Robot



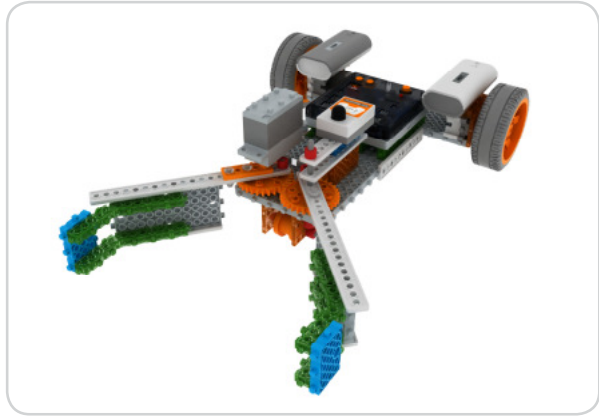
4. The little car 'Bumboo'



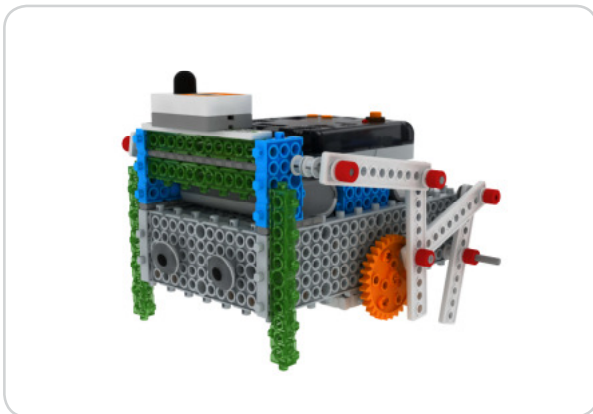
5. Fencing Robot



6. Catapult



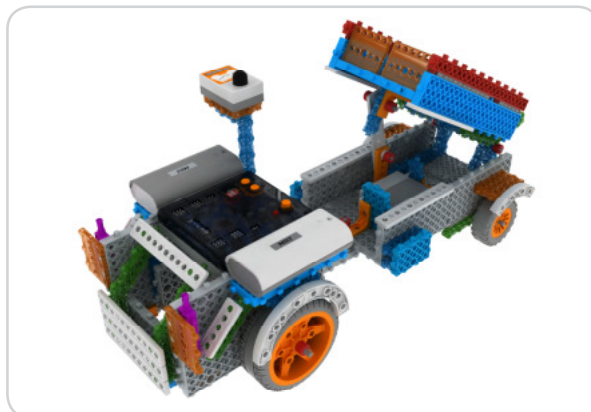
7. Forceps Robot



8. Bug Battle Bot



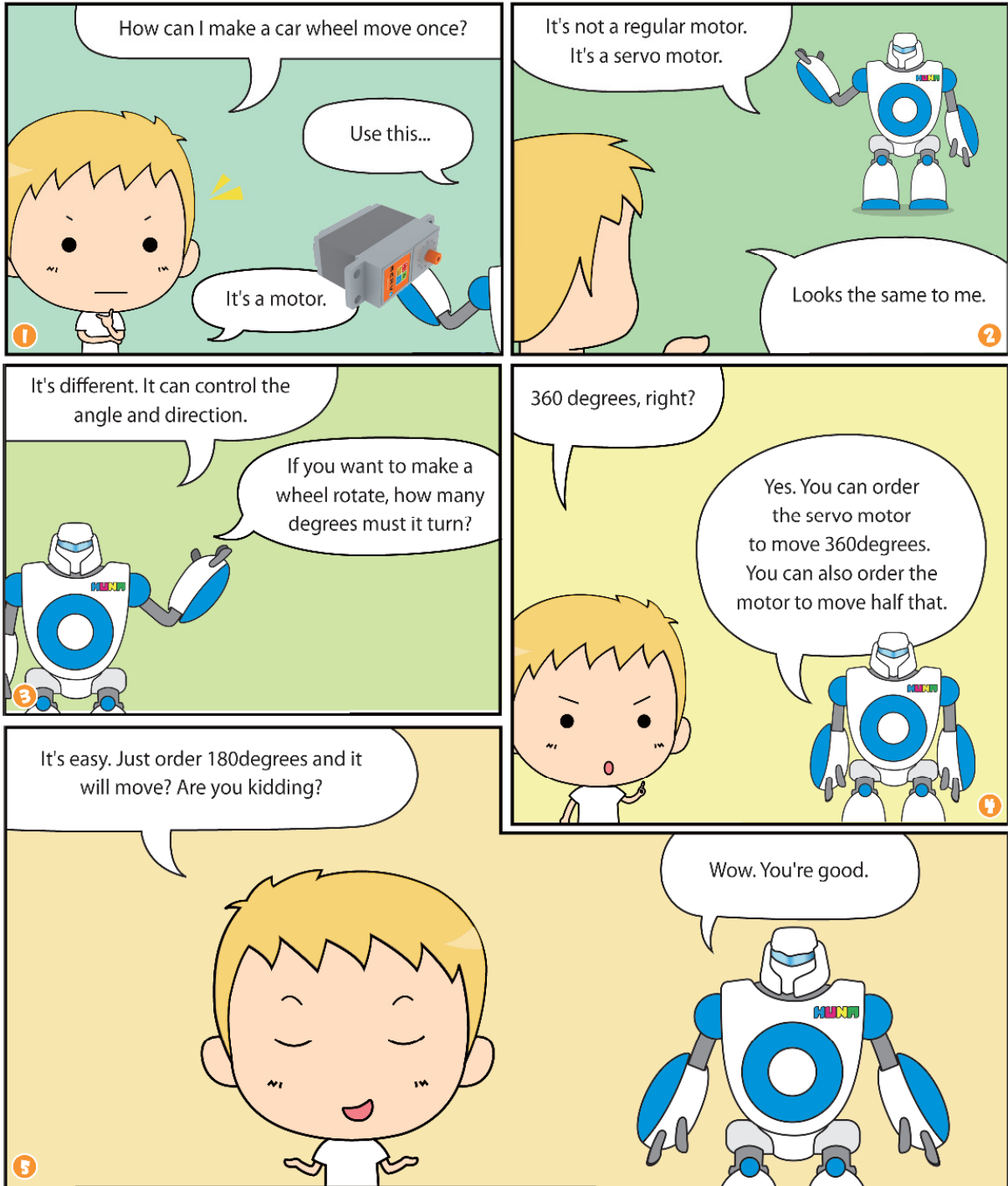
9. Cleaner Bot



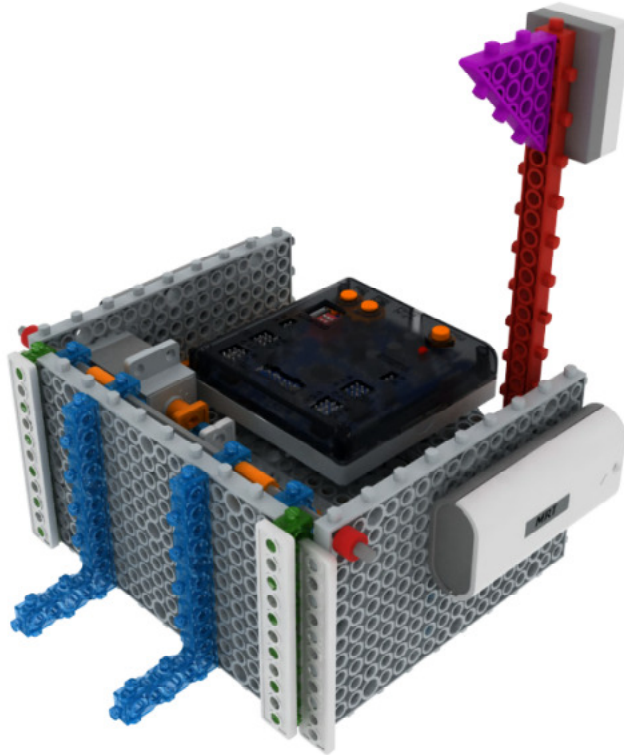
10. Dump Truck



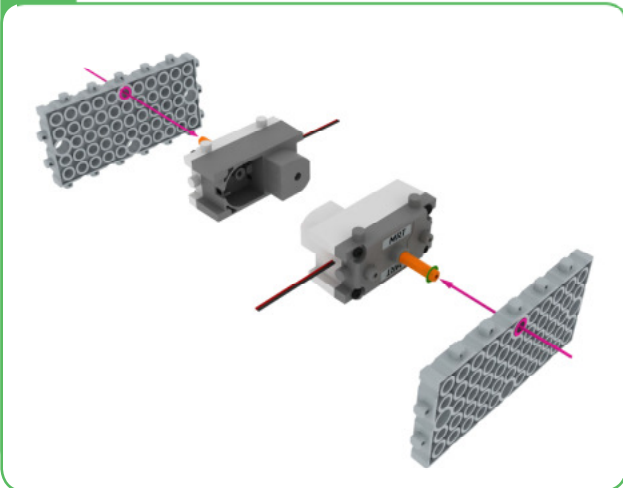
STEM 1. Servo Motor



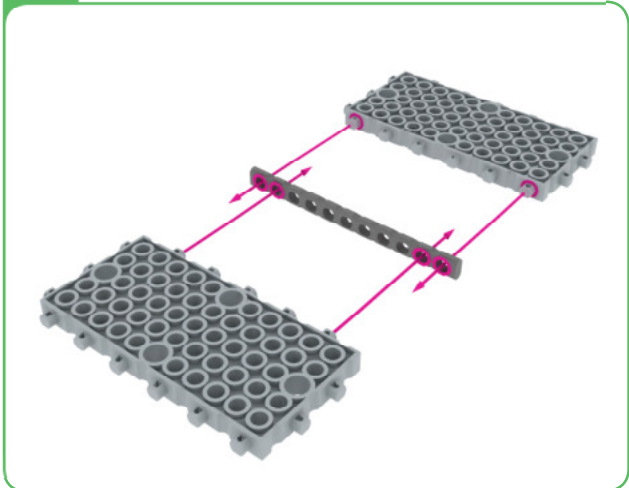
T Technology **Robot Making 1-Soccer Robot**



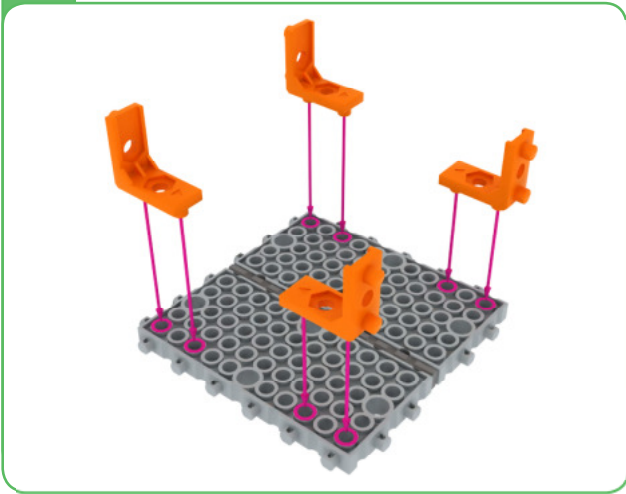
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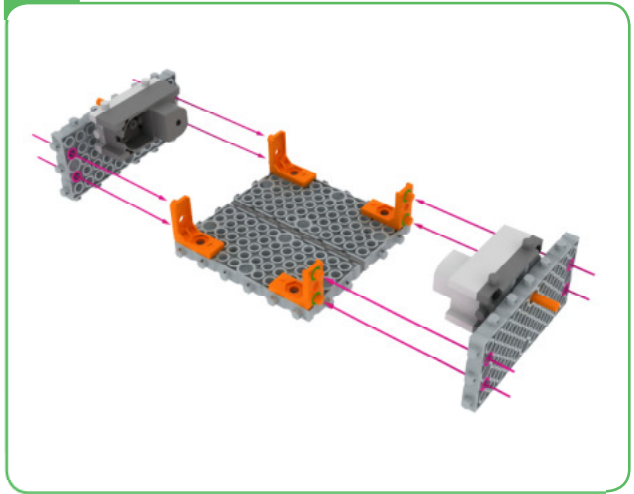
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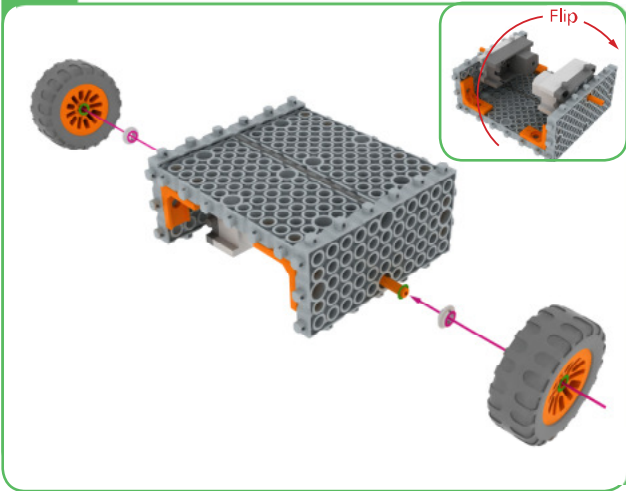
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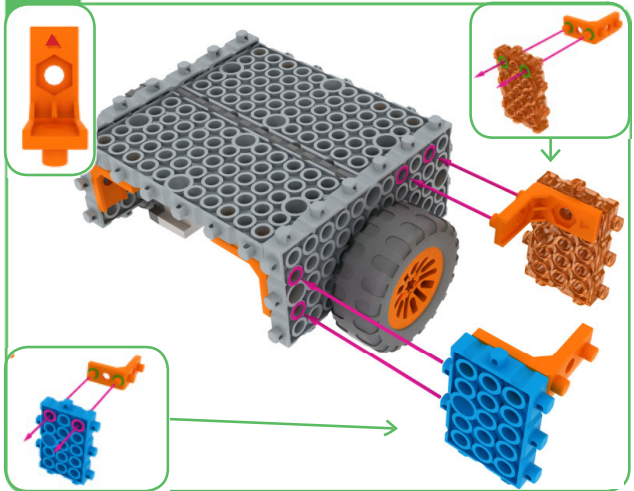
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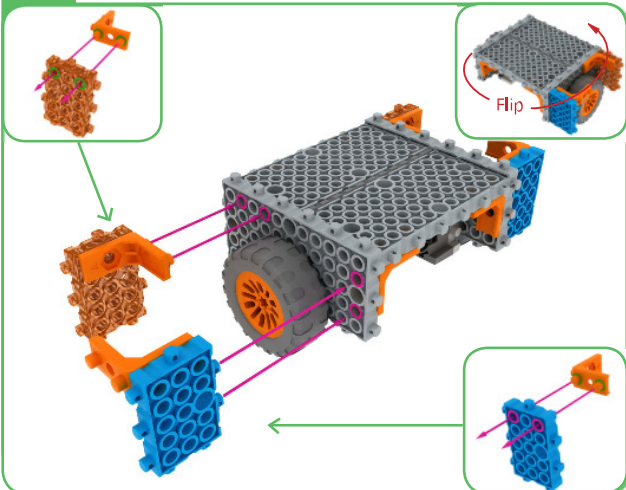
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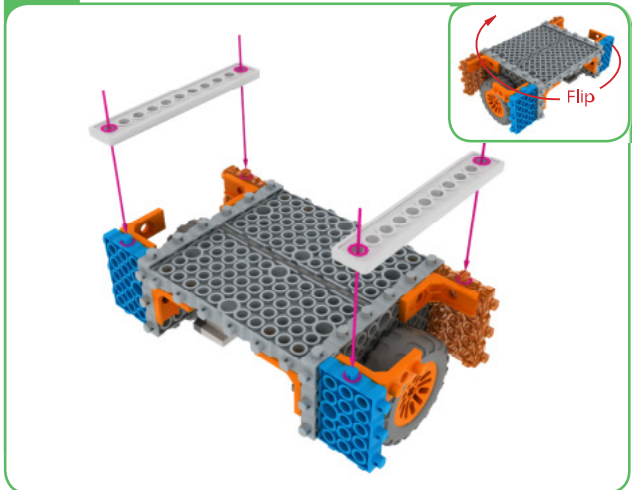
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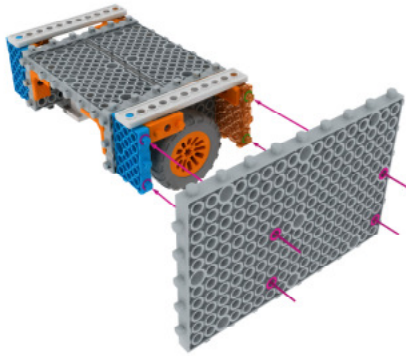
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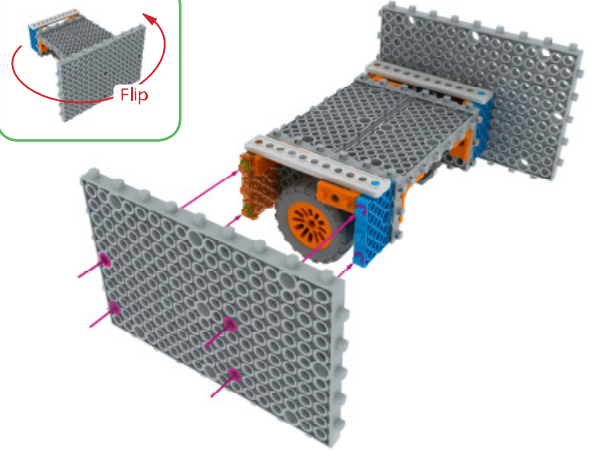
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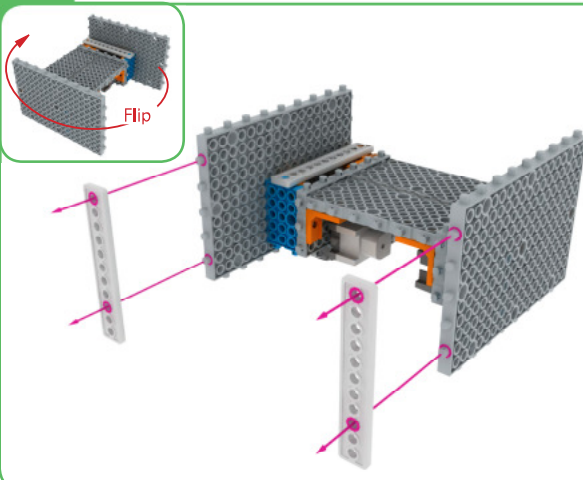
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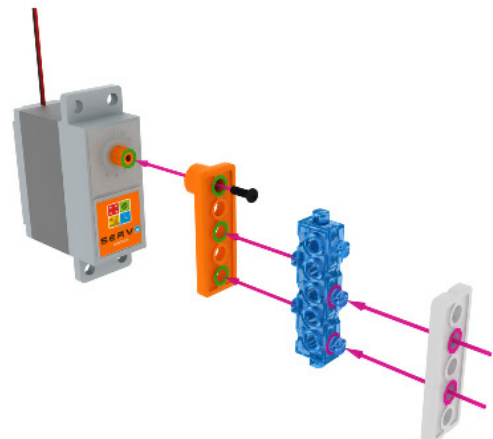
10



11



12




Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

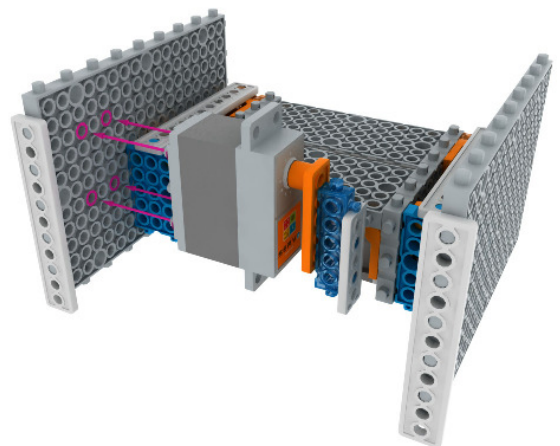
```

PROGRAM
START{
  Servo:[Servo 1(OUT1)]=[0]
END}
    
```

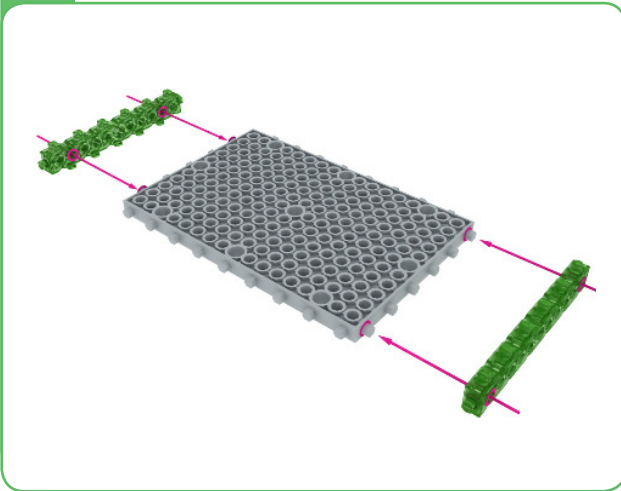


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

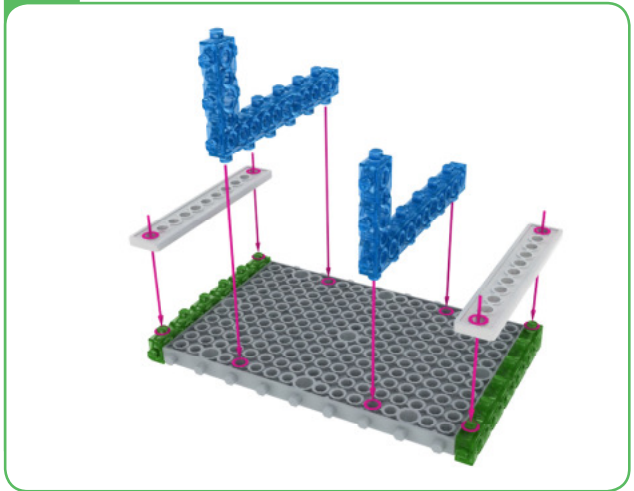
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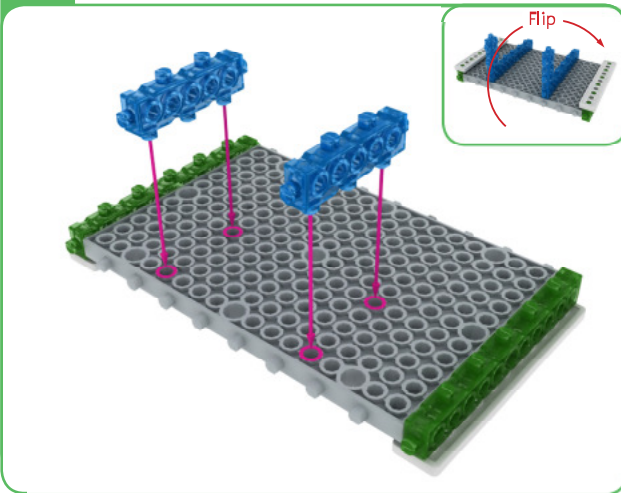
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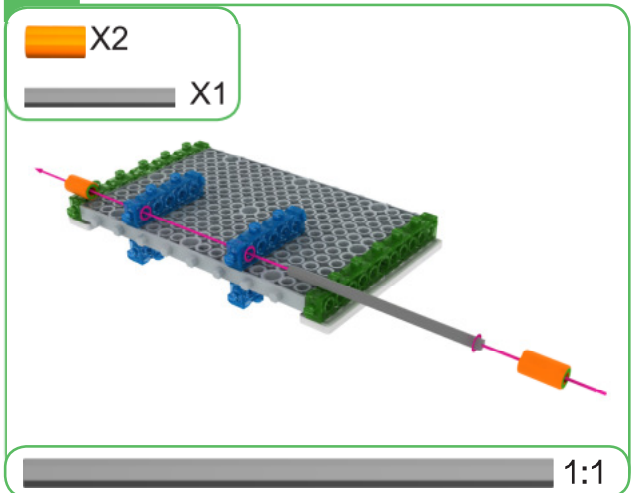
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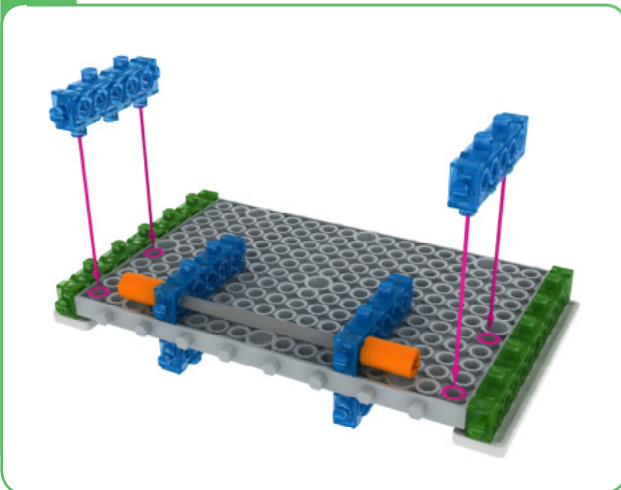
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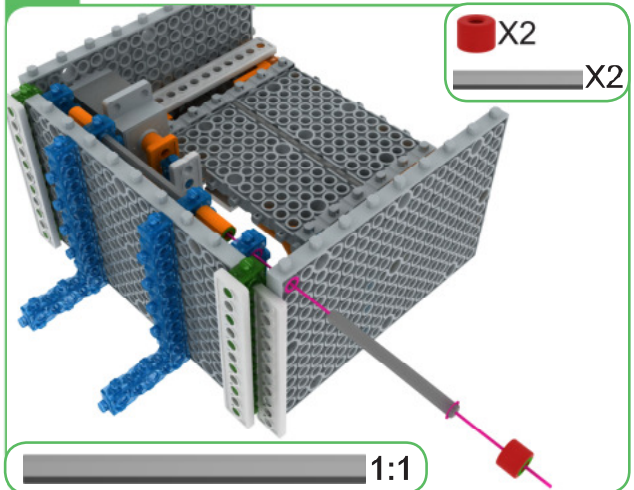
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18



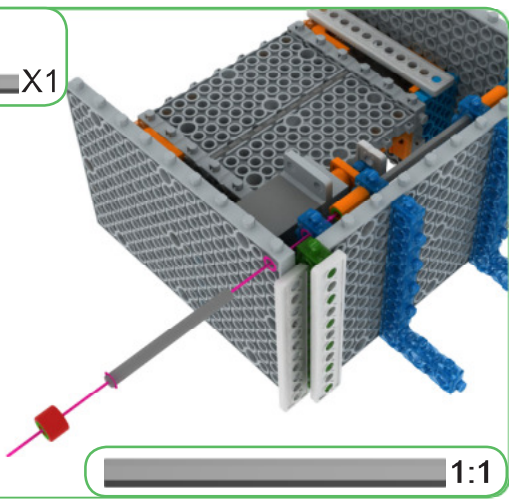
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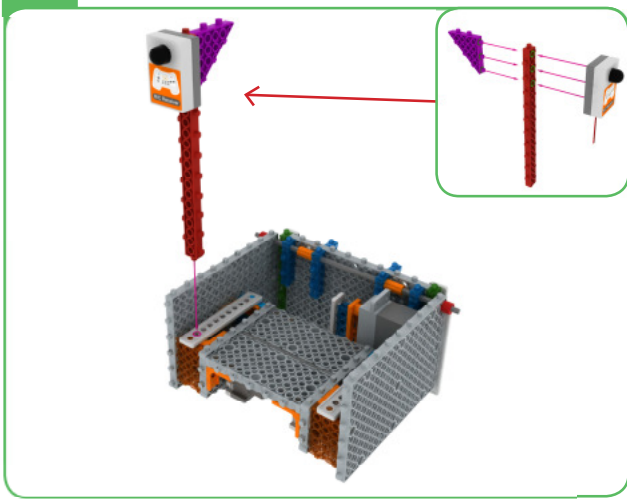
Intermediate Level

20

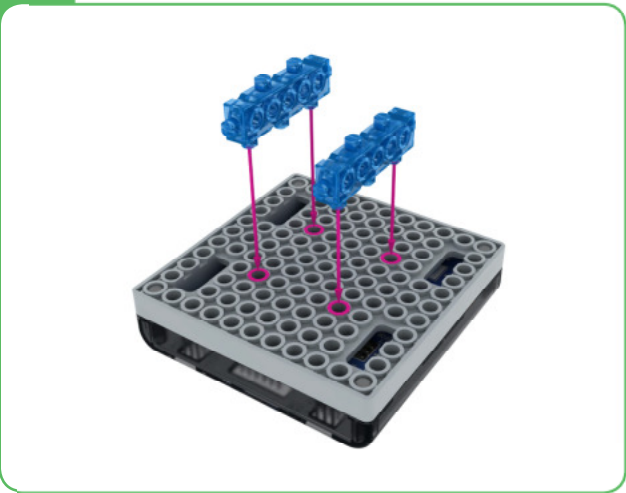
X1



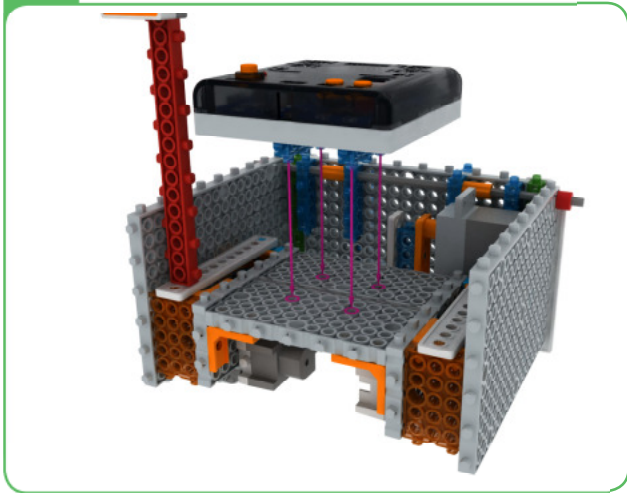
21



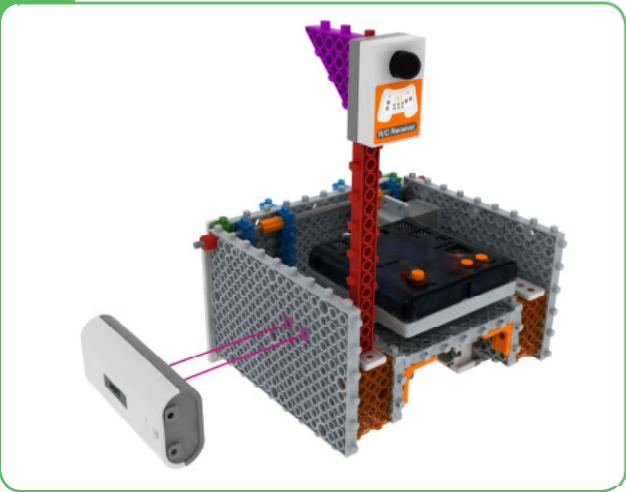
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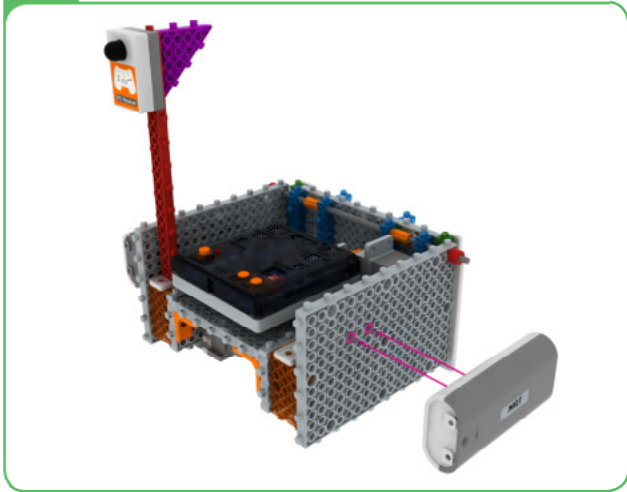
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24



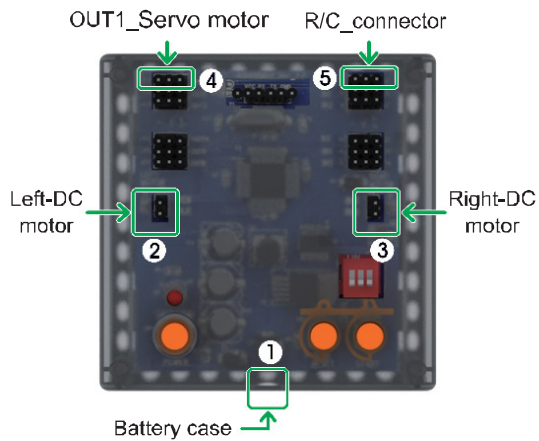
End





How to operate the Soccer robot2

Connecting the main board

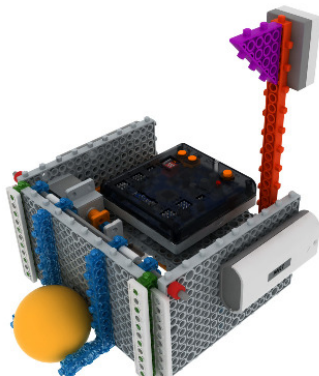


Connect in this order.

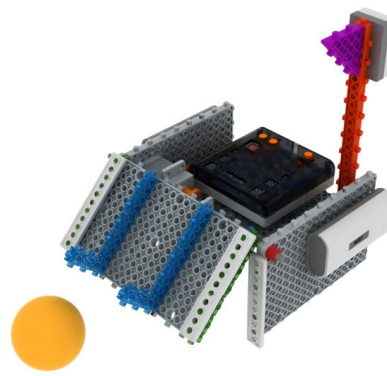
1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.

Motion Pattern/Program

Ball Dribling



Ball Dribling

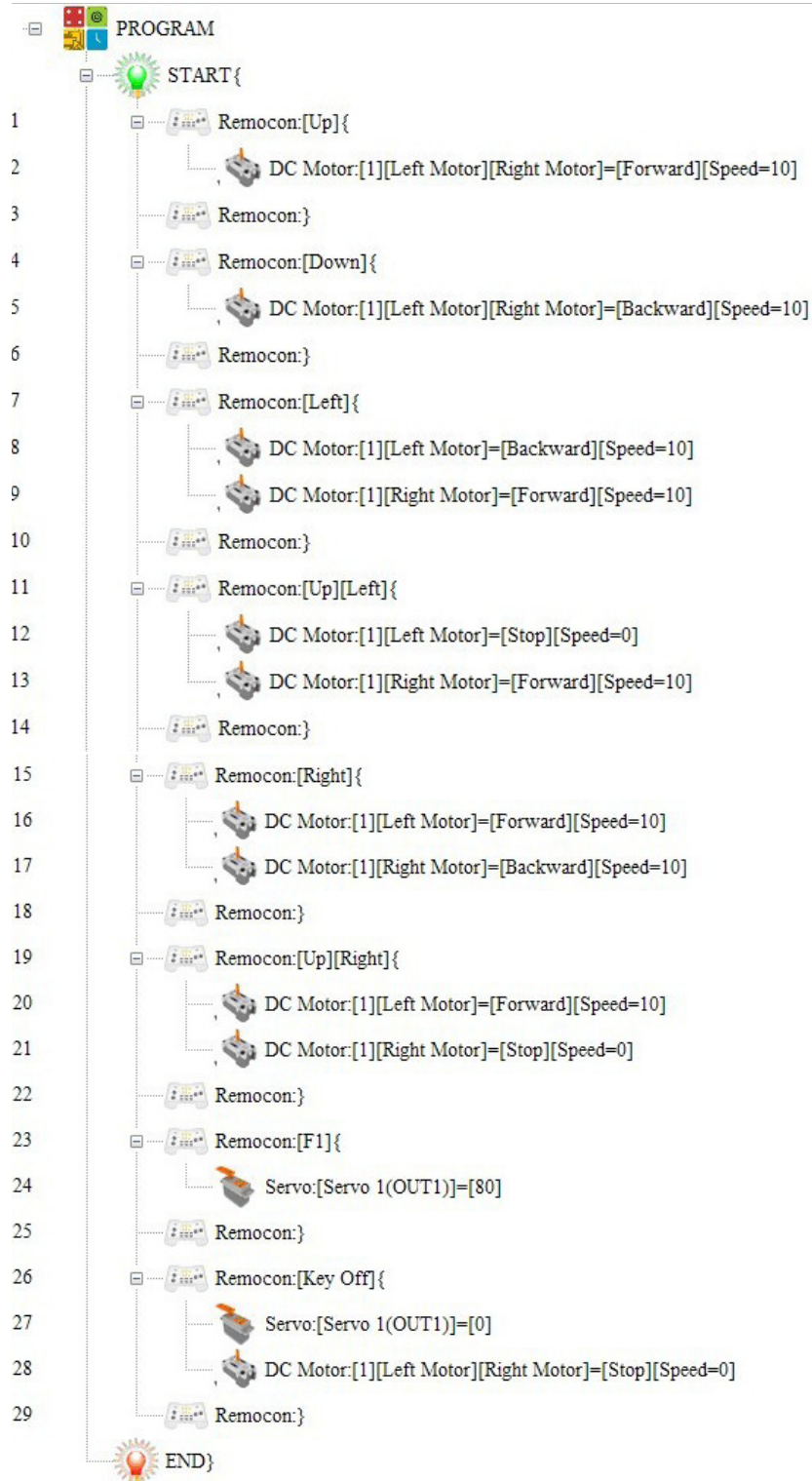


※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

Program Example



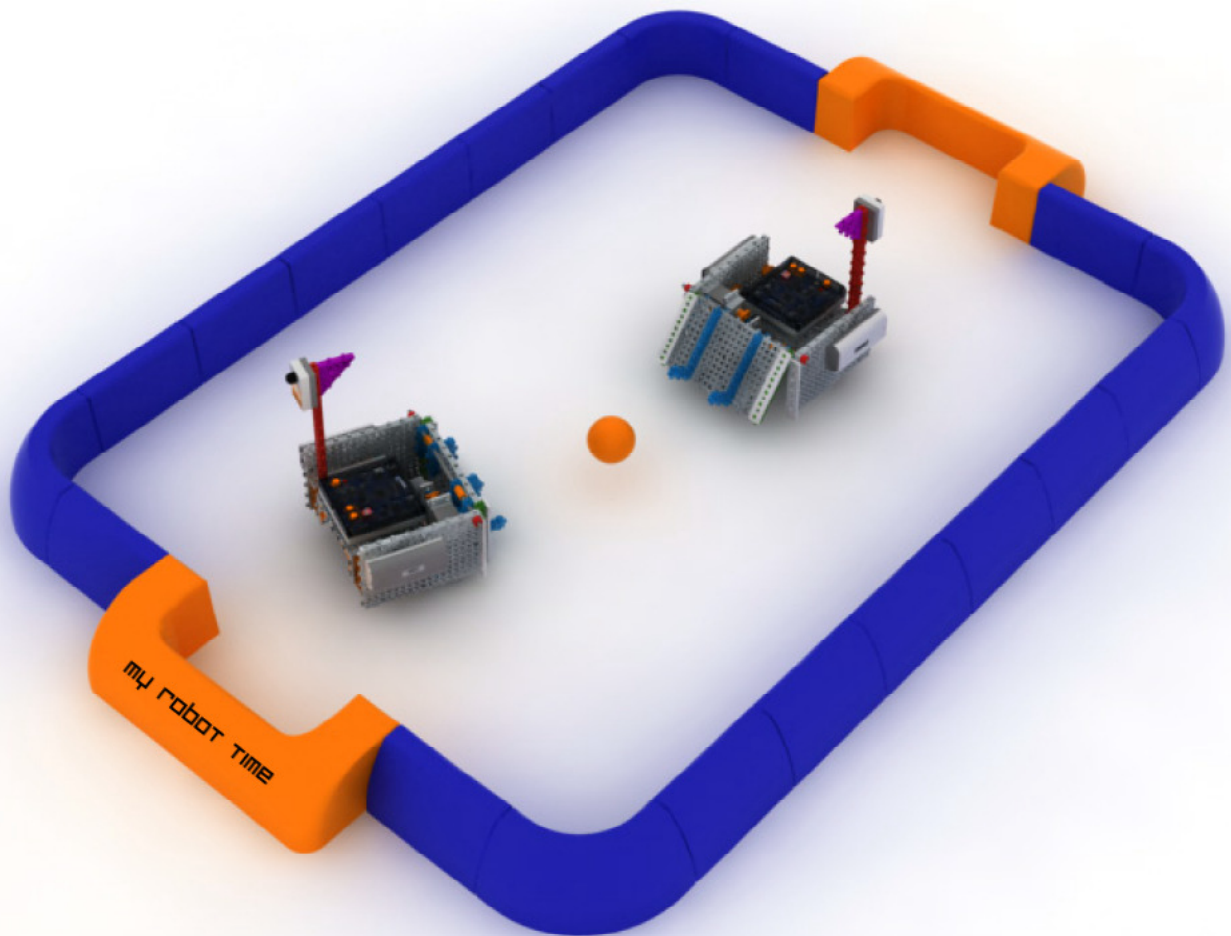
MY ROBOT TIME



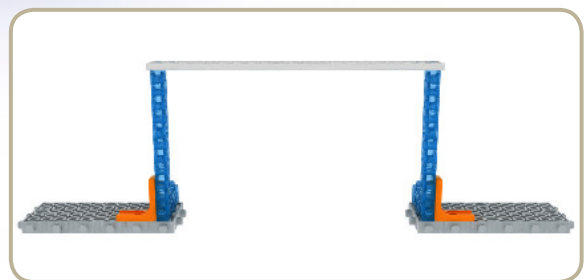
Art

Assemble Soccer Robot and two soccer goal post, let's make a soccer competition with your friends

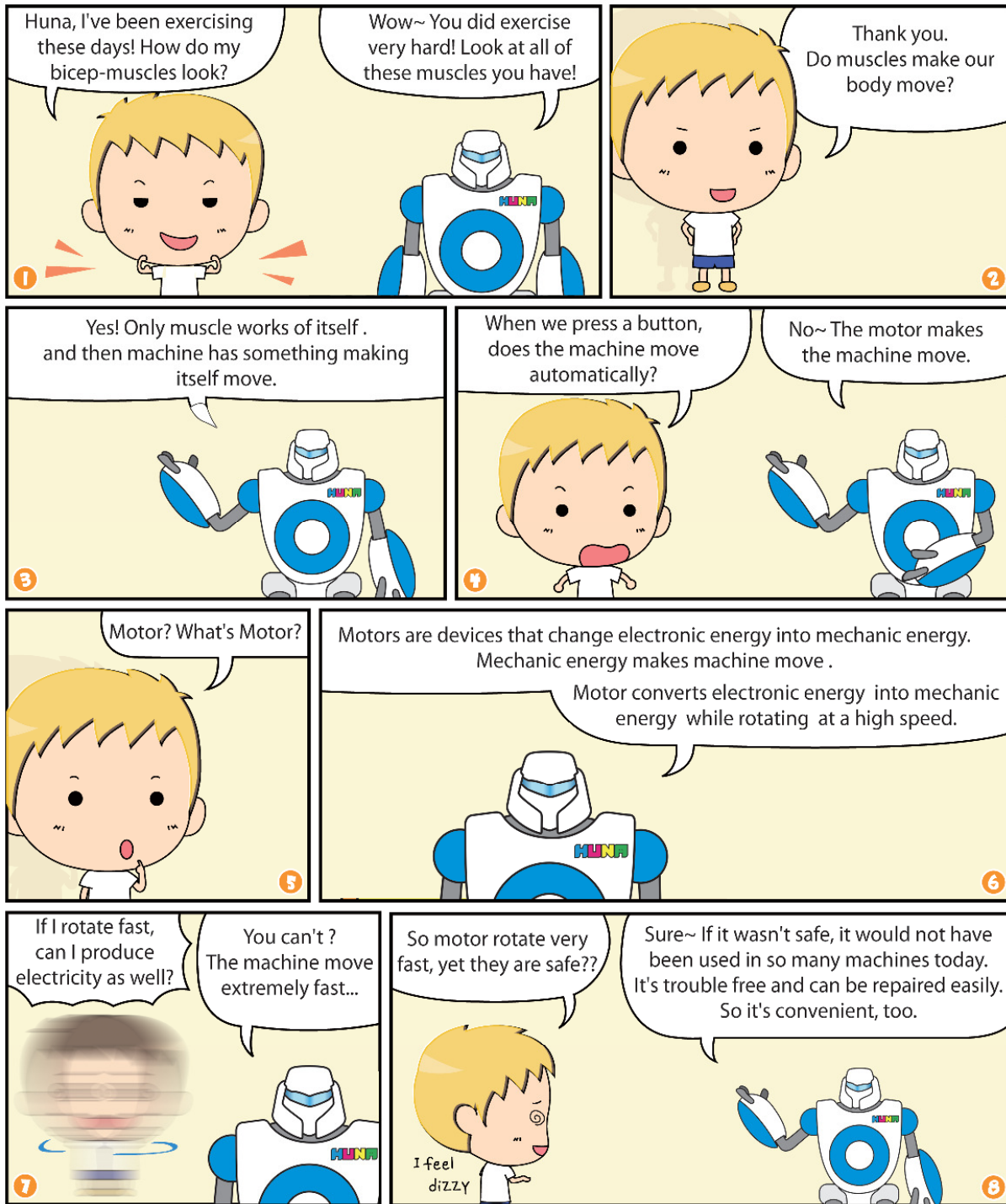
Assemble a soccer goal post



※DIY SOCCER STADIUM



S Science **STEM 2. How muscles make us**
E Engineering **move just Like machines!-Motor2**



T Technology **STEM 3. The robot's brain-The**
M Mathematics **binary numbers (Light ON | OFF)**

1 Aliens! What an earth are they talking about!

Ⓞ#\$\$!^#Ⓞ\$%!!!

well~

If there even is such a thing as alien languages, then robot has to have a language as well, right?

Of course, we call it machine language. The language system is used by all machines.

2

what does this machine language look like?

Machine uses two decimal number, 0 and 1. Machine only use these two digits!

3

let's use a fluorescent light an example! The ON switch conveys the digit '1' to the fluorescent light. The OFF switch conveys the digit "0" to the fluorescent light.

ON → 1 →

OFF → 0 →

So, If the fluorescent light receives the digit '1', it will turn on. Oppositely, when it receives the digit '0', it will turn off. **4**

But how can only 0's and 1's represent so many languages?

We can represent it by increasing the number of 0's and 1's we use. I will show you a few numbers. I think you will understand.

0 → 0	4 → 100
1 → 1	5 → 101
2 → 10	6 → 110
3 → 11	7 → 111

5

Oh! I see, By the way, why do you only use binary numbers?

Binary numbers only recognize 2 decimal number, 0 and 1. So there can only be a few errors and it also works faster. It's really speedy!

6

If that is so, can you translate this printed letter for me?

10101
00110
11101
11101
01010

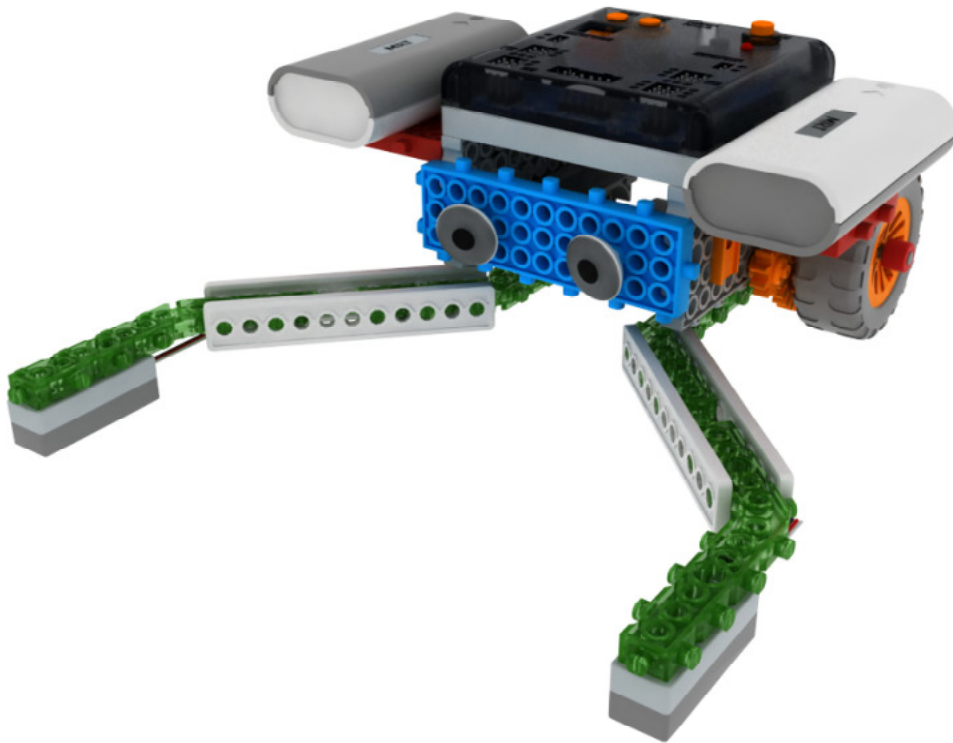
Ahh .. This .. is just a "printing error."

Ah, Ha ha.. **7**

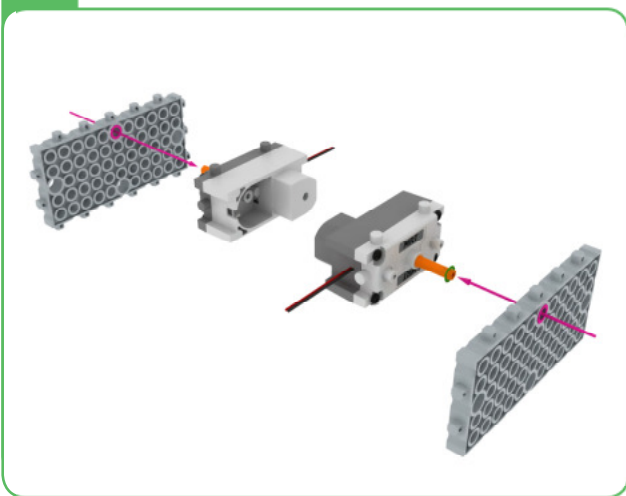


Technology
Engineering

Robot Making2-Hemiptera



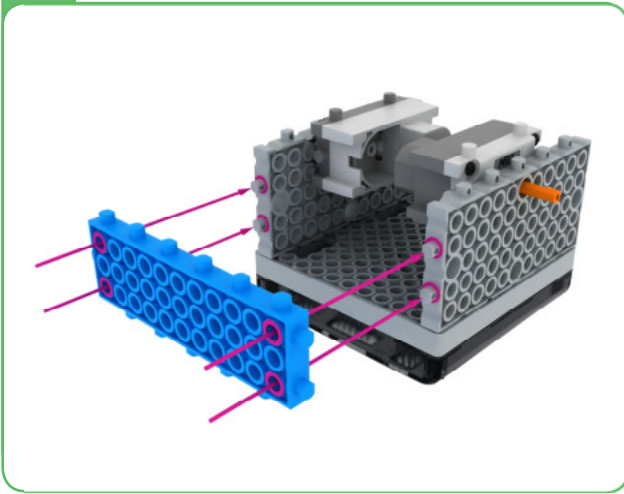
1



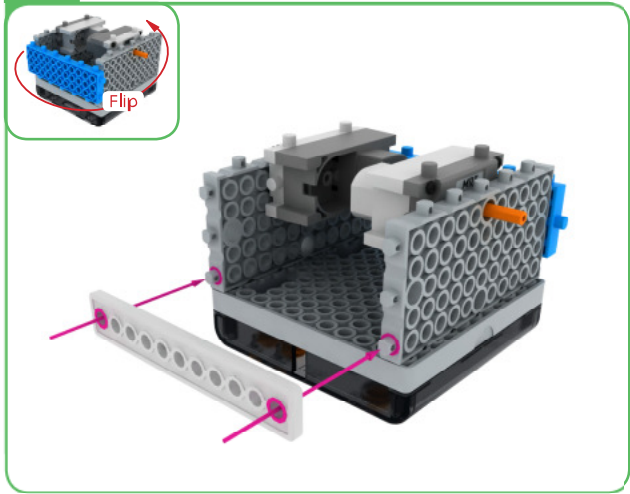
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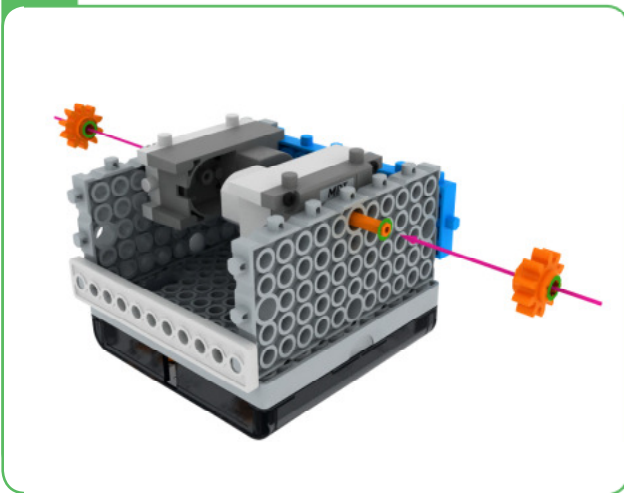
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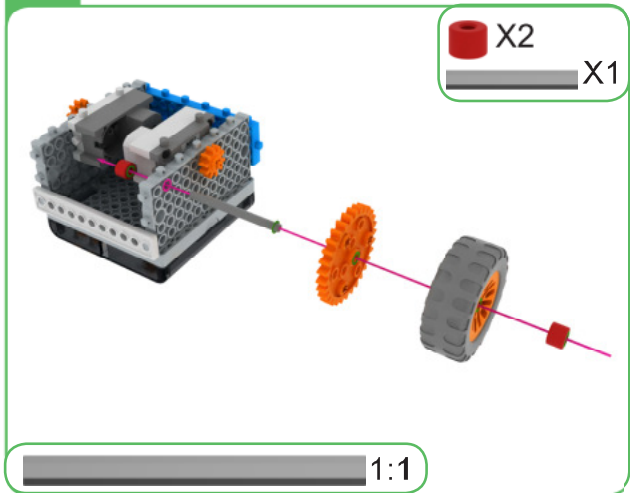
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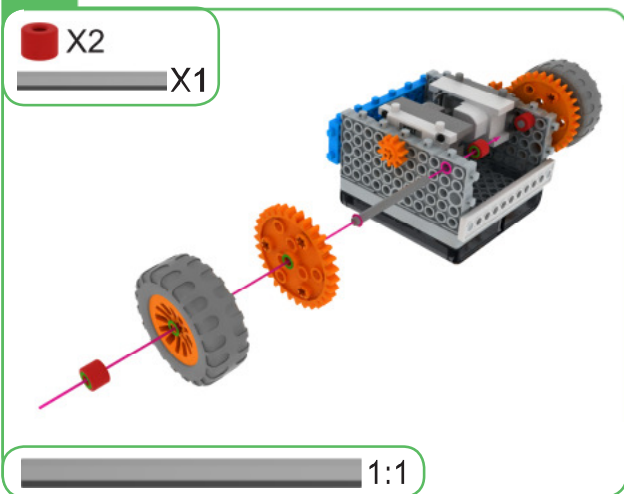
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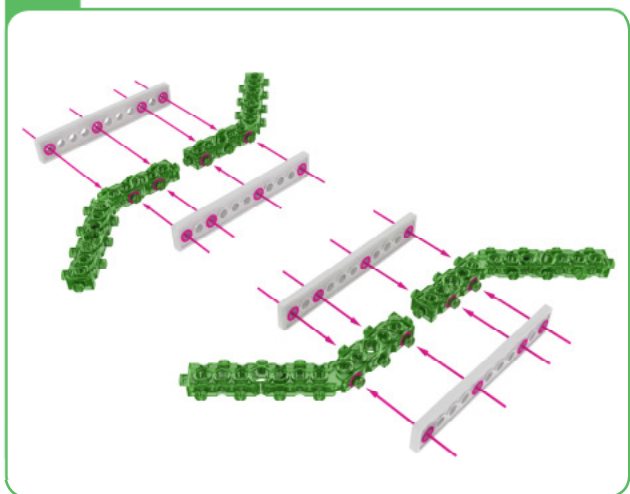
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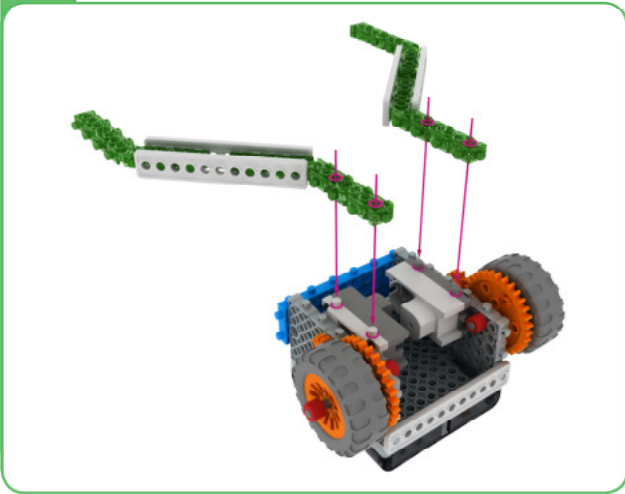
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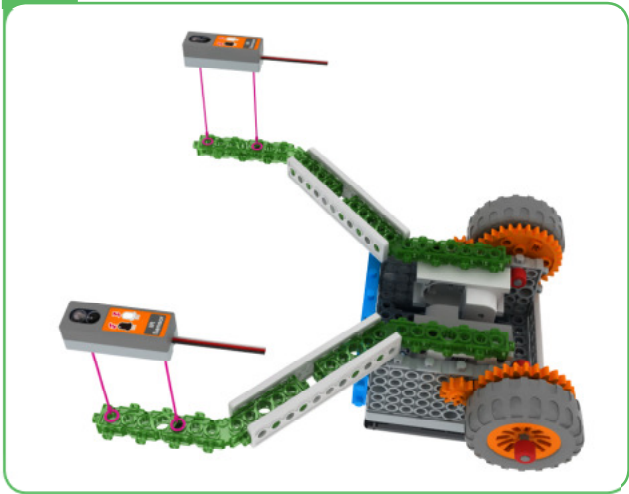
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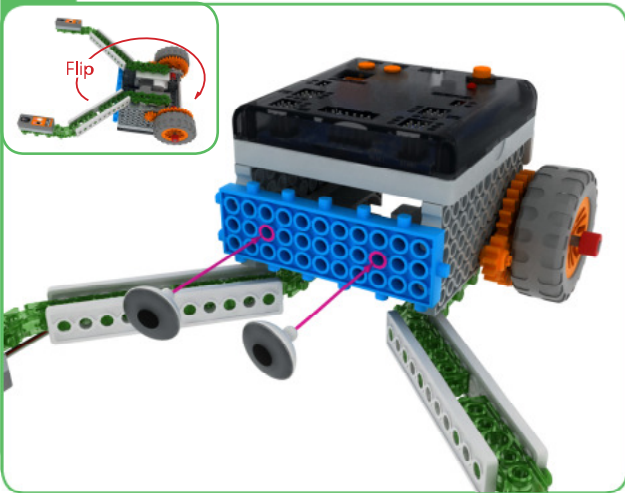
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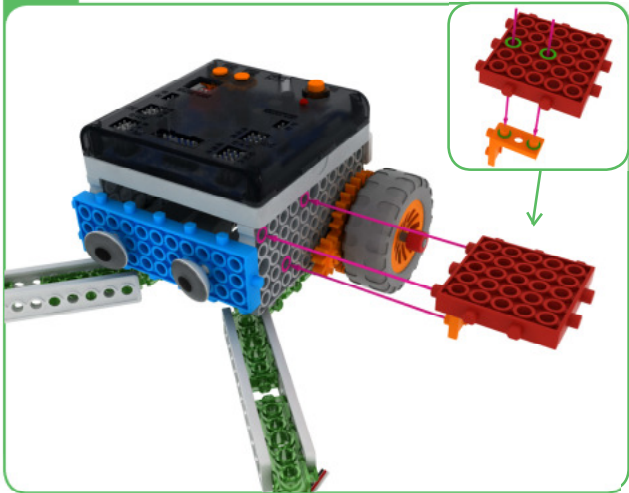
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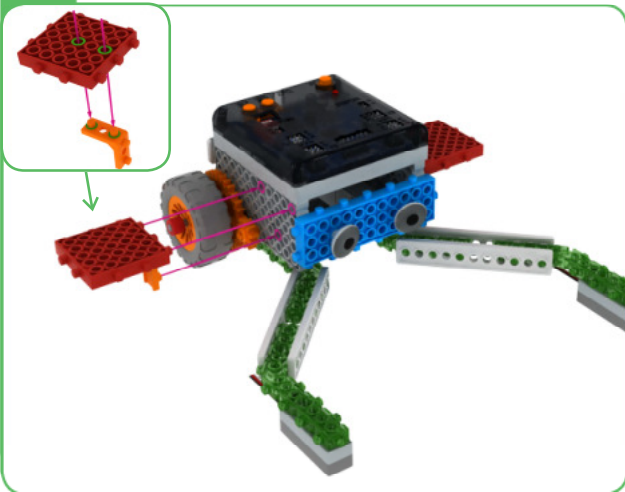
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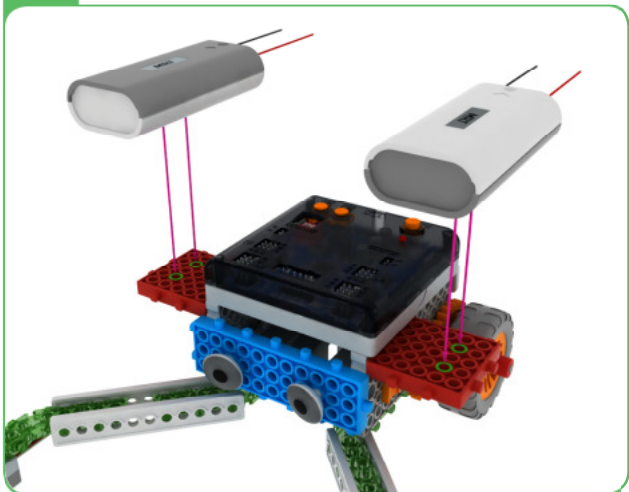
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13



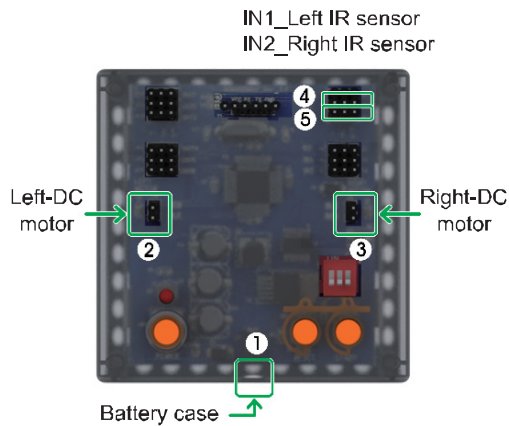
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How to operate the Hemiptera

Connecting the main board

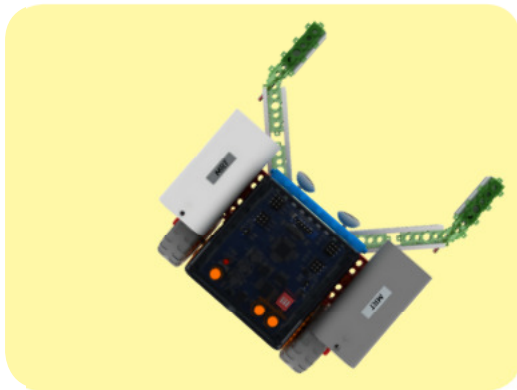


Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Left IR sensor to IN1 of INPUT connector.
5. Connect Right IR sensor to IN2 of INPUT connector.

Motion Pattern/Program

※ A bright colored table



1. When left side Infrared sensor perceive a cliff, It will move backward. It will make a right turn and will go straight forward.
2. when right side Infrared sensor perceive a cliff, It will move backward. It will make a left turn and will go straight forward.

※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

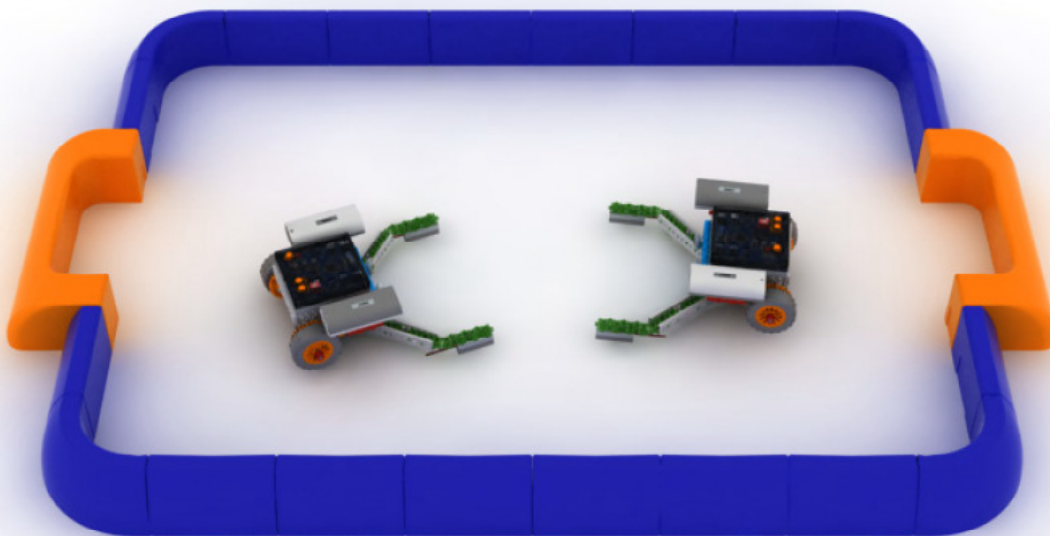
Program Example

```

1  IR:[IN1]=[Sense][IN2]=[Sense]{
2  DC Motor:[1][Left Motor][Right Motor]=[Backward][Speed=8]
3  IR;}
4  IR:[IN1]=[Sense][IN2]=[None]{
5  DC Motor:[1][Left Motor][Right Motor]=[Forward][Speed=8]
6  Delay:[0.5 sec]
7  DC Motor:[1][Left Motor]=[Forward][Speed=8]
8  DC Motor:[1][Right Motor]=[Backward][Speed=8]
9  Delay:[0.5 sec]
10 IR;}
11 IR:[IN1]=[None][IN2]=[Sense]{
12 DC Motor:[1][Left Motor][Right Motor]=[Forward][Speed=8]
13 Delay:[0.5 sec]
14 DC Motor:[1][Left Motor]=[Backward][Speed=8]
15 DC Motor:[1][Right Motor]=[Forward][Speed=8]
16 Delay:[0.5 sec]
17 IR;}
END}
    
```



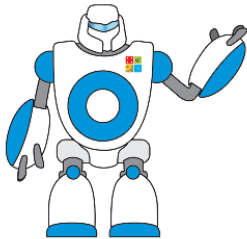
Art *Let's organize your own team for hockey competition*





Technology
Mathematics

STEM 4. Replacing the numbers with binary numbers



When modifying numbers with binary numbers, use the following rules.

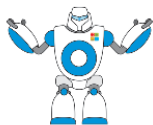
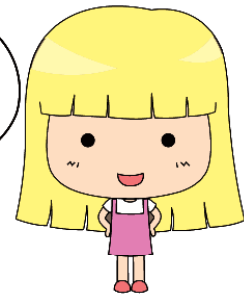
- 1) Divide the number to be replaced by 2 decimal with 2, write the rest down.
- 2) Quotient is divided by 2, divided by 2 again, then write the remainder down.
- 3) Keep on dividing by 2 until the result is 1. Repeat the process.
- 4) When the division is done, write the bottom share and the remainders in the order as it was calculated.

$$\begin{array}{r} 2 \overline{)13} \end{array}$$

$$\begin{array}{r} 2 \overline{)6} \quad \dots \quad 1 \\ 2 \overline{)3} \quad \dots \quad 0 \\ \underline{1} \quad \dots \quad 1 \end{array}$$

$$13 = 1101_{(2)}$$

To distinguish between the general number 1101 from 1101 binary number, a decimal is used. For instance 1101(2), Just add the decimal marker (2) behind the binary number.



Please select one 2 digit number and convert the number into 2 decimal numbers.

A large blue spiral-bound notebook with several blank, lined pages for student work.

T Technology **STEM 5. The Robot's Skin -The Touch Sensor**

1 Sally: Hey~Huna, I haven't slept much lately. I feel so tired.
Huna: You know, Sally! Sleeping at night is really important for your skin's health.

2 Sally: Yeah, yeah, I used to have smooth skin, but these days... my goodness, I'm sleepy right now.
Huna: Wake up! The sun is shining! Let's get started! I'm gonna tell you about skin!

3 Sally: About skin? Are you gonna tell me how I should take care of my skin?
Huna: Ha ha, no, not about that! Do you know that the robot also has skin?

4 Sally: Really? Then they are like people.
Huna: A robot's touch sensor is attached to the outside of the robot. The touch sensor makes up for the skin of the robot.

5 Sally: Aha~, so if the robot is touched by something, it might make the robot move in same way.
Huna: That's right~ Do you know what things makes use of these sensors?

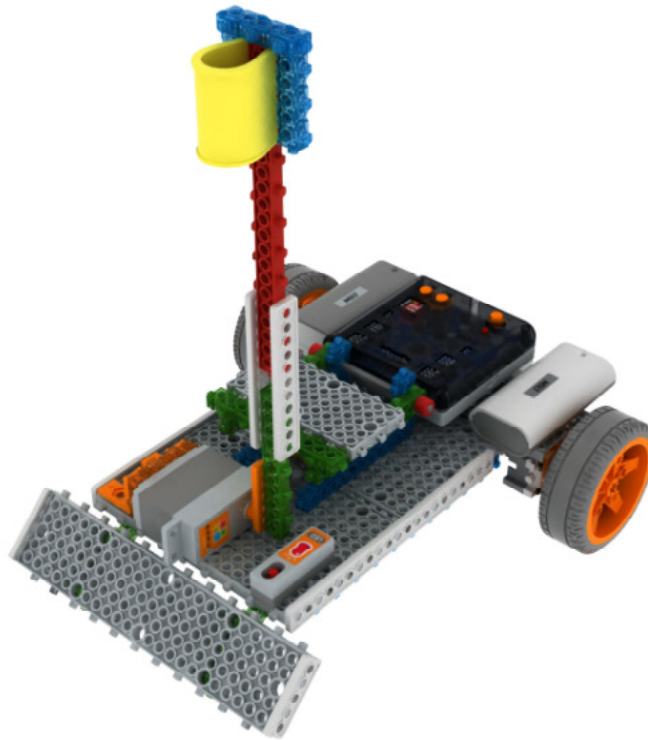
6 Sally: Of course! My phone has a touch pad. It turns on when I use the touch sensors.
(Image of a hand holding a smartphone)

7 Sally: Wow, you've got a impressive cellphone! MP3 players also uses touch sensors. Many machines uses touch sensors these days.
(Image of a hand holding a smartphone)

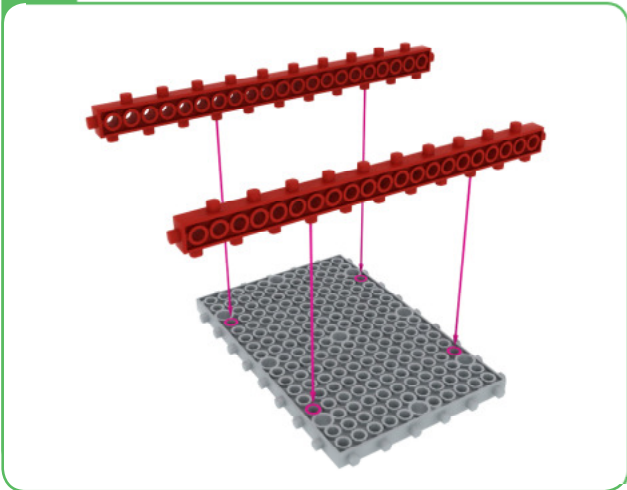
8 Sally: And I saw that my rice-cooker and microwave also have touch sensors!
Huna: Right~ There is a lot of things out there that use touch sensors! Let's see what other things use touch sensors!



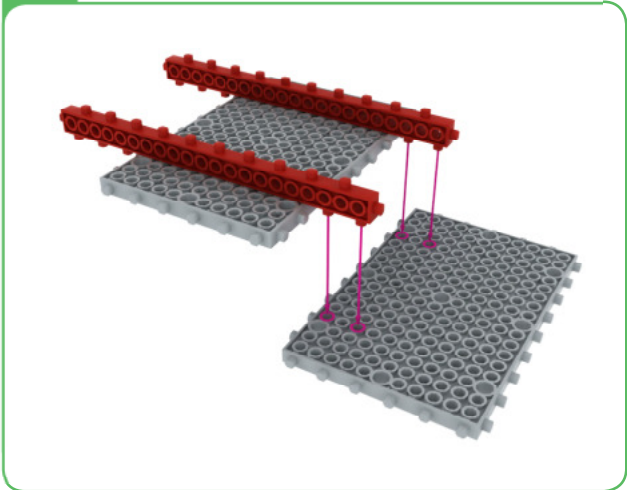
Robot Making3-Touch battle Bot



1

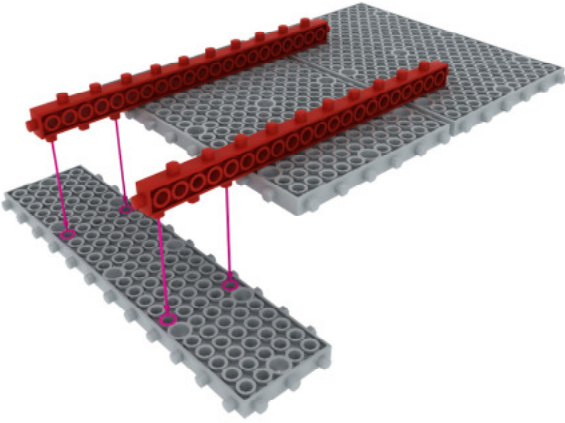


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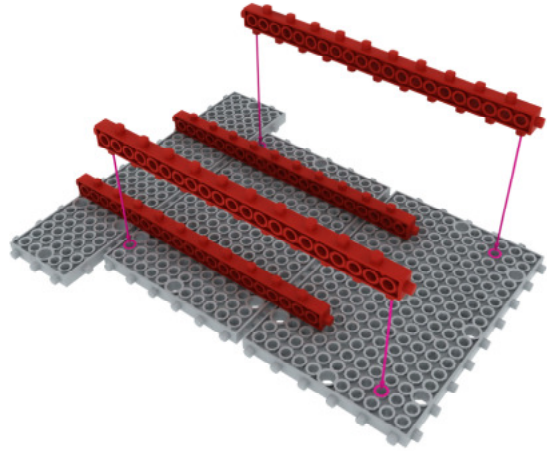


Intermediate Level

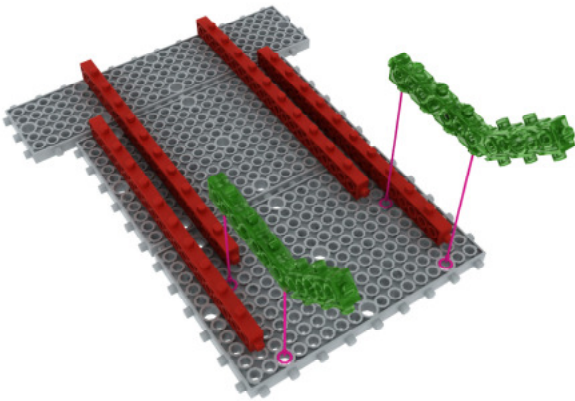
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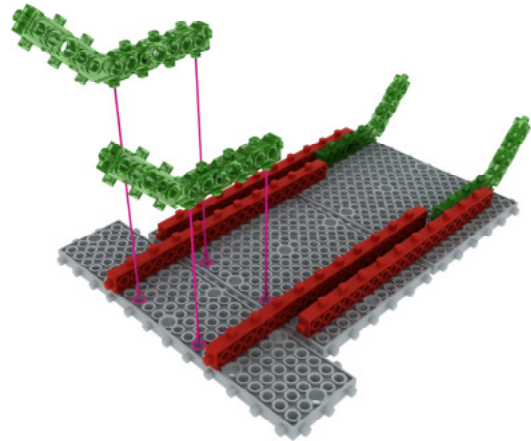
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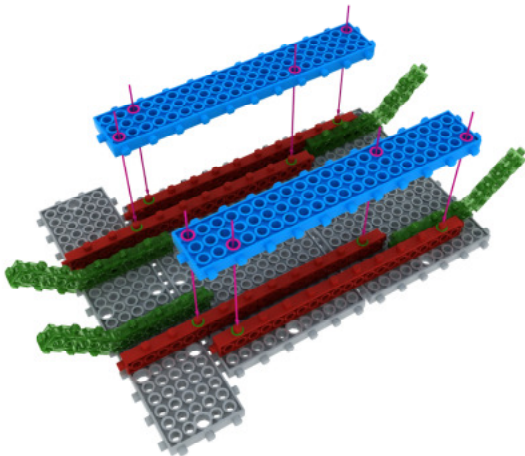
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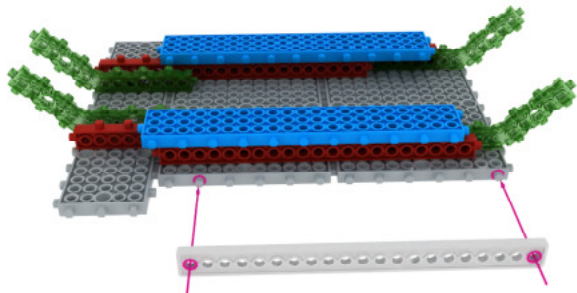
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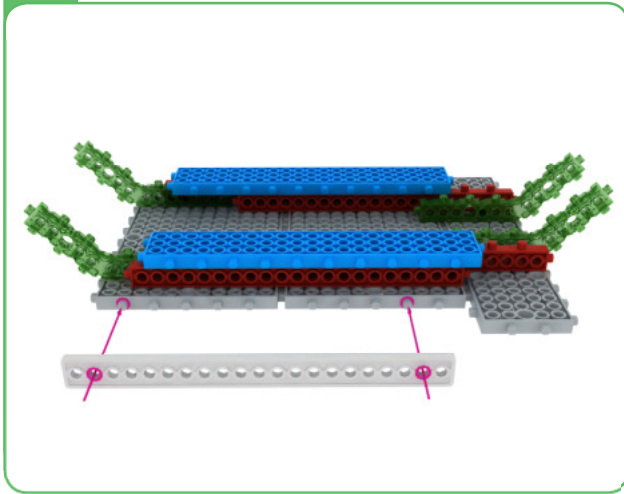
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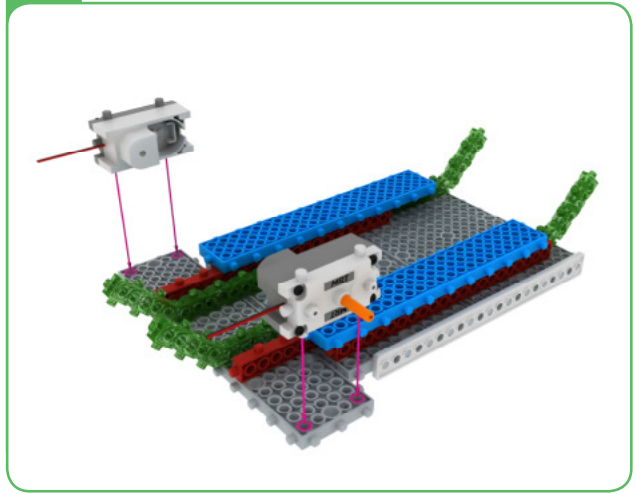
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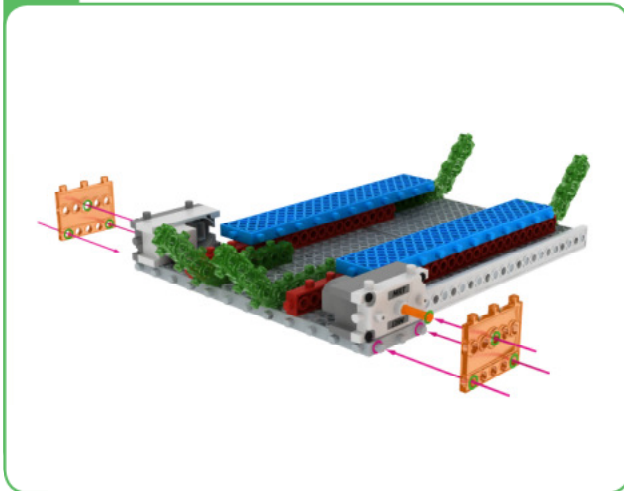
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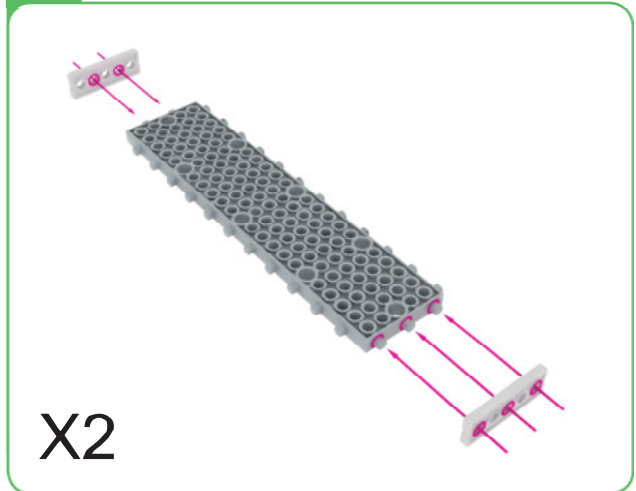
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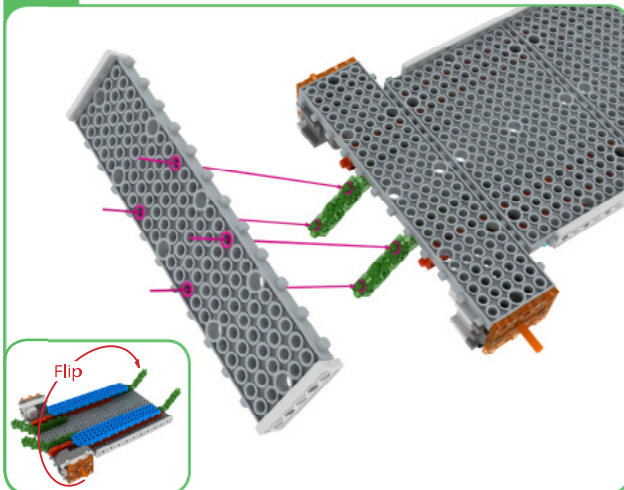
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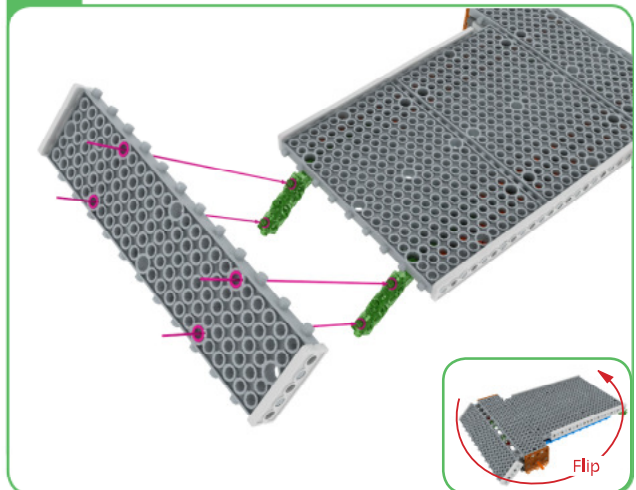
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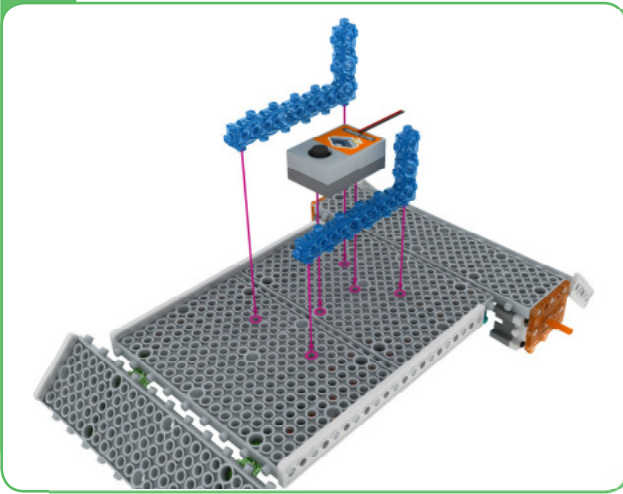
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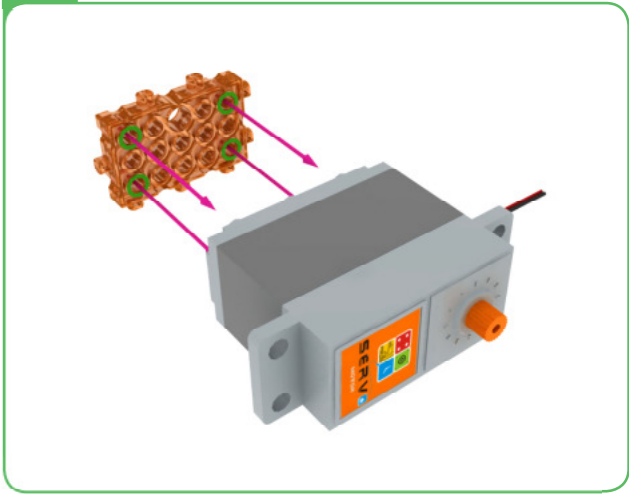
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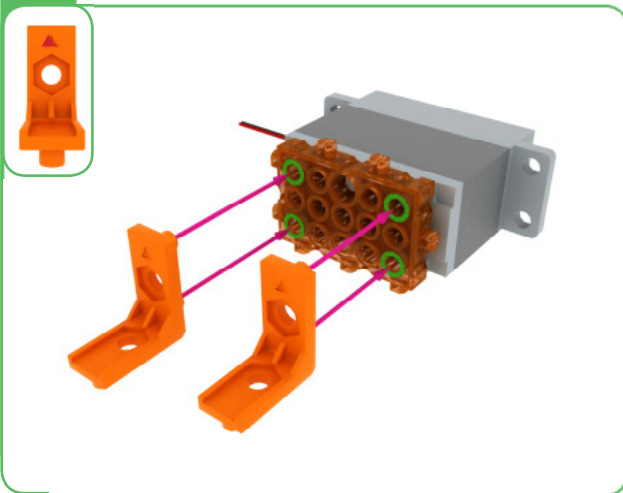
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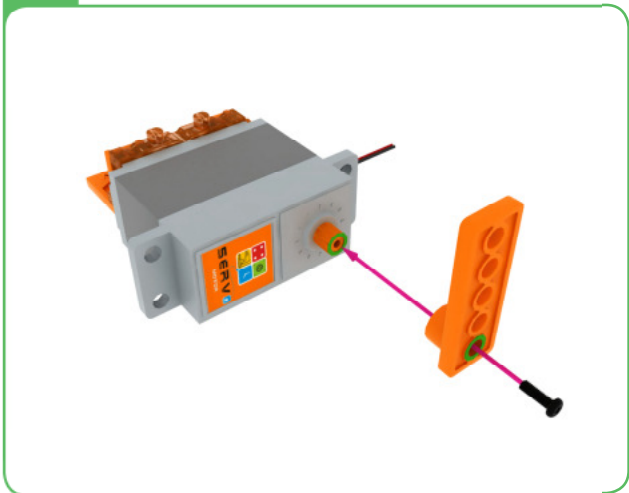
16



17



18




Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

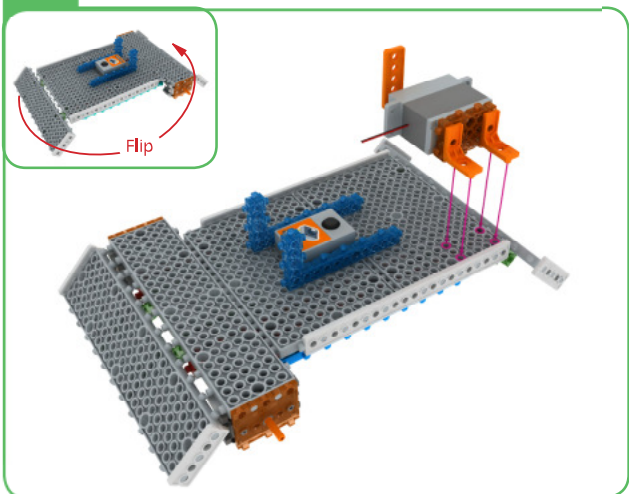
```

PROGRAM
START{
  Servo:[Servo 1(OUT1)]=[0]
END}
    
```

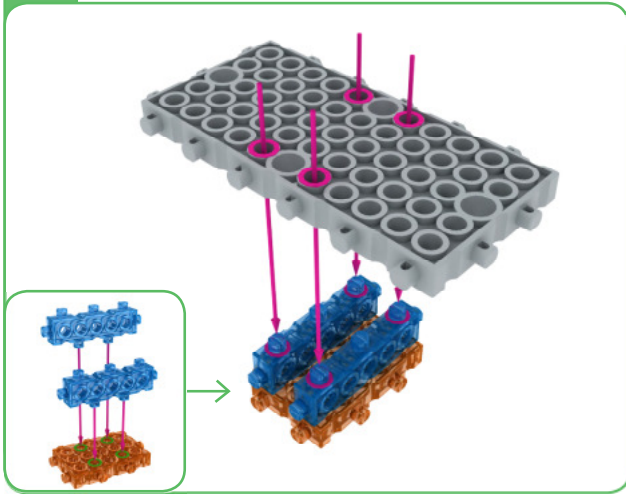


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

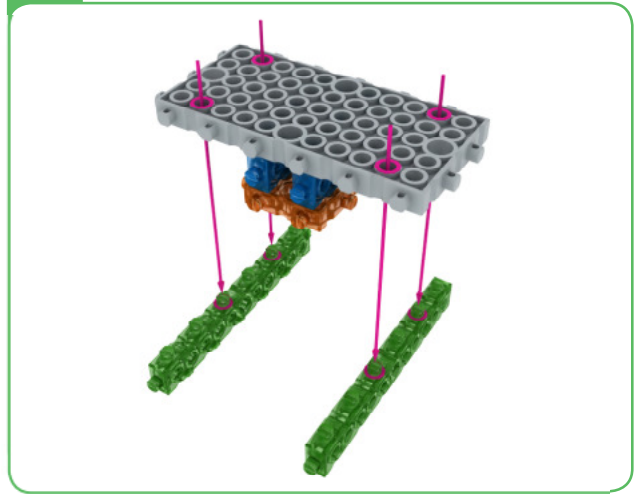
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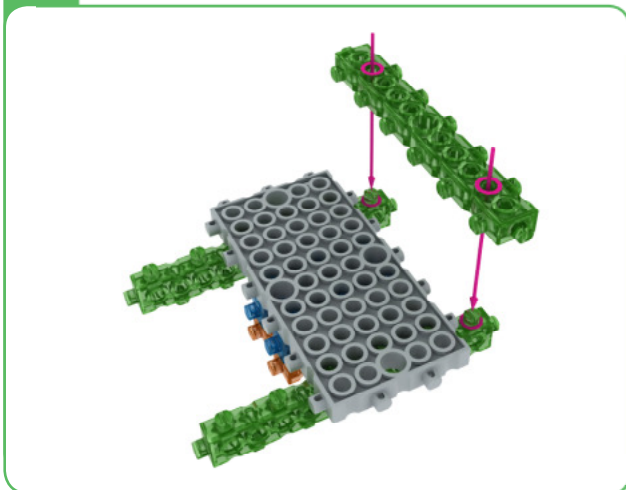
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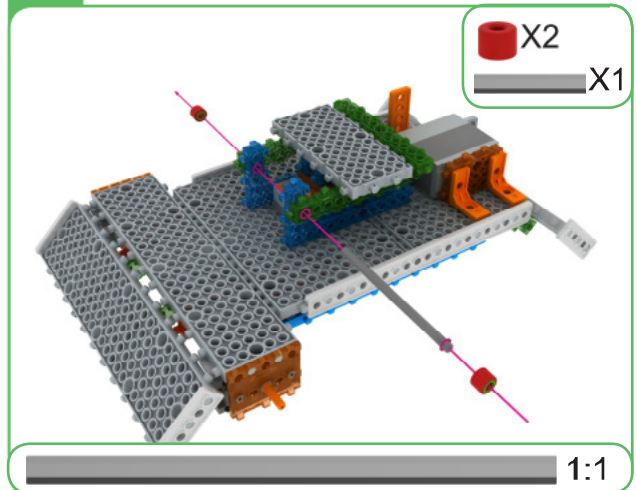
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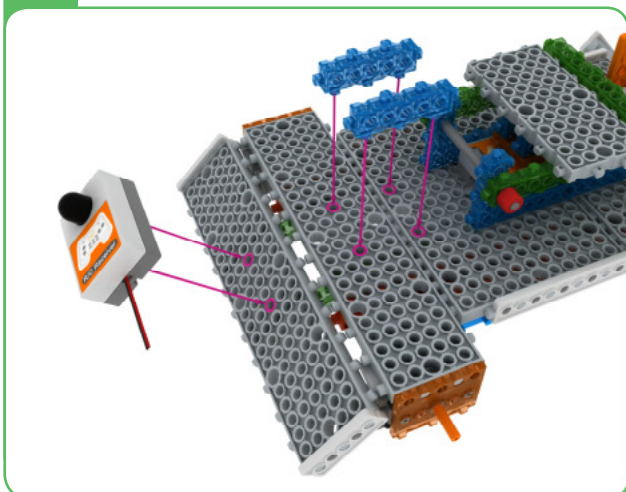
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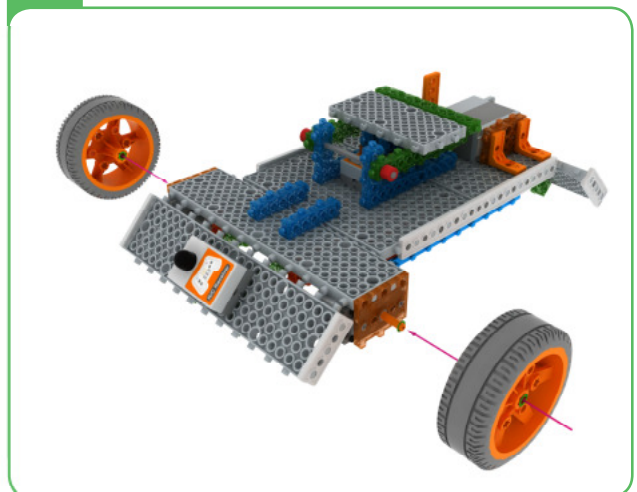
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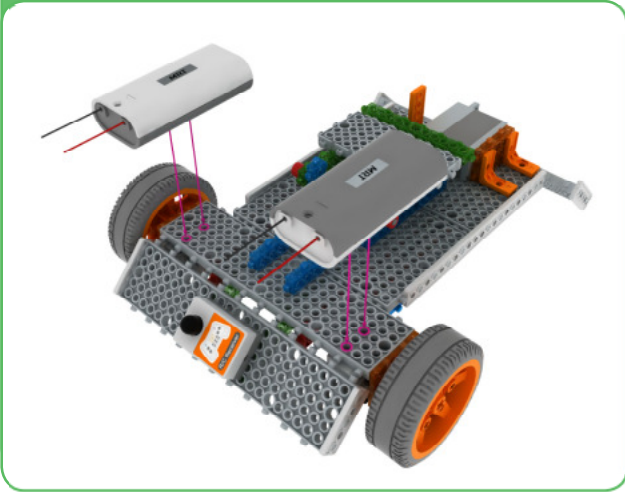
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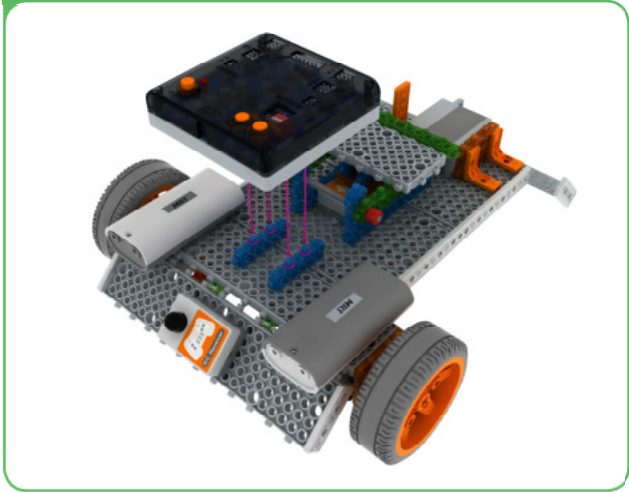
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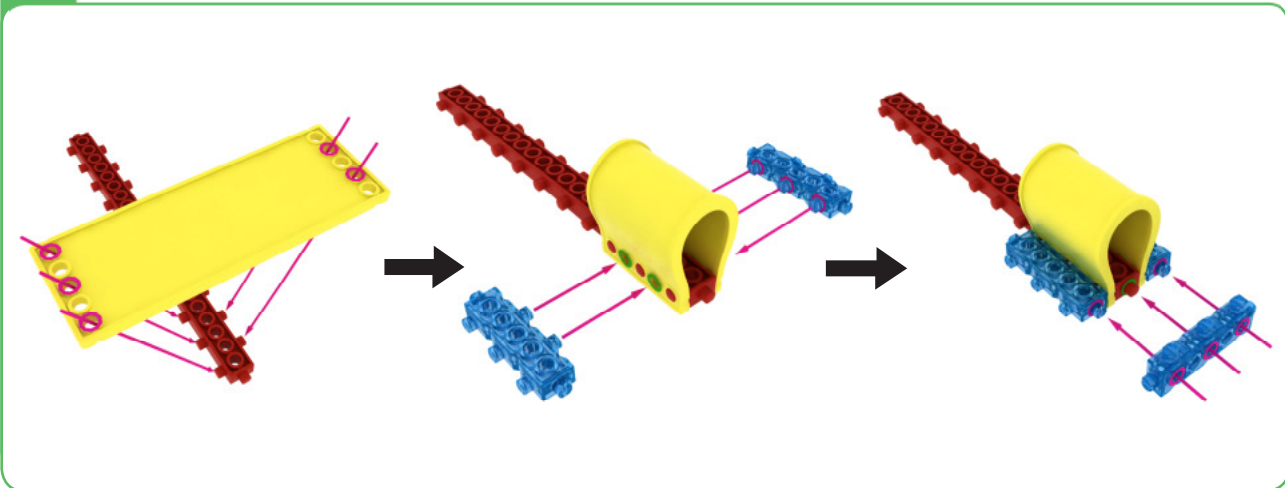
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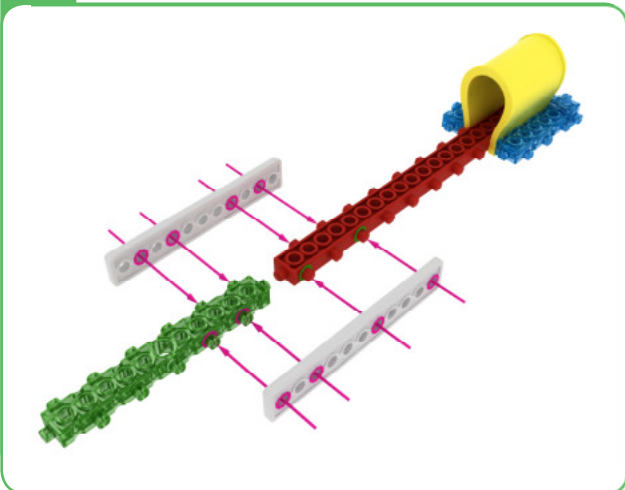
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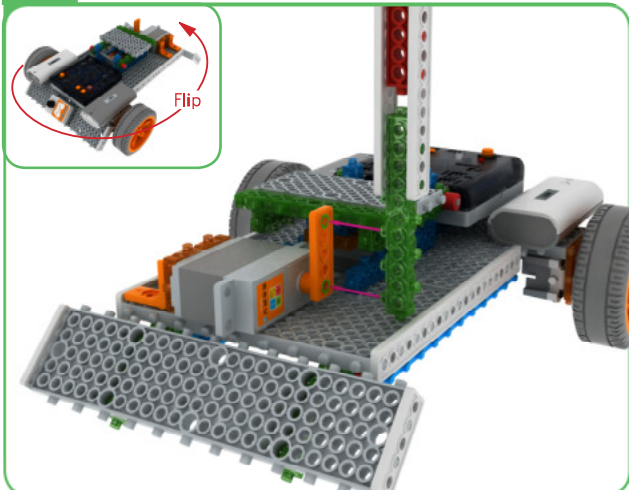
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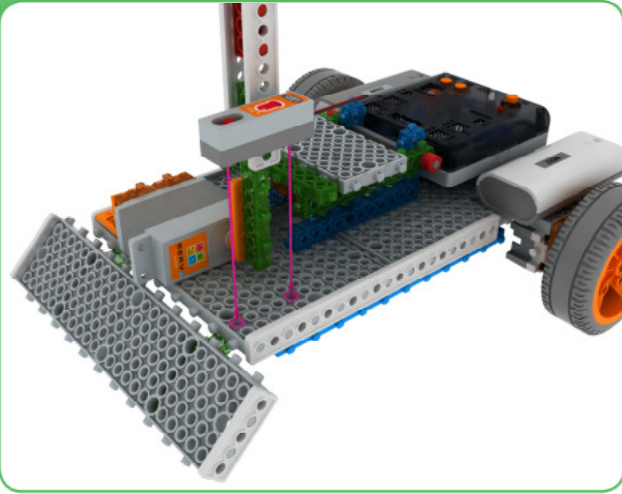
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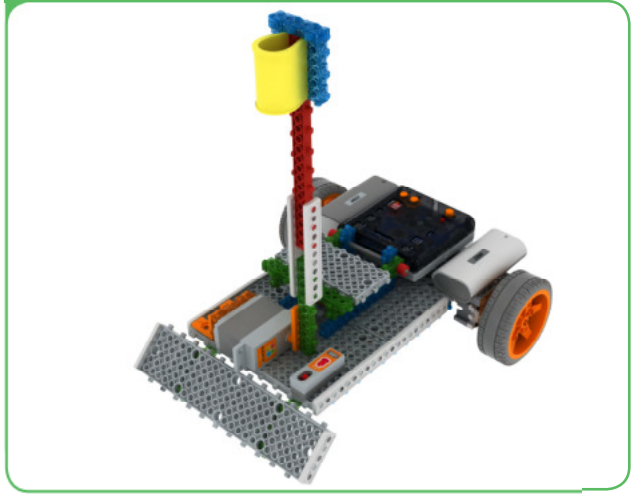
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31



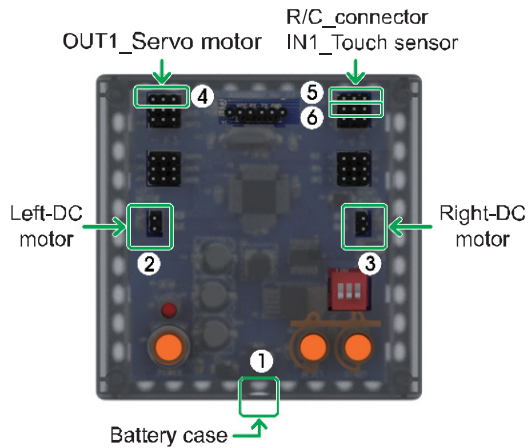
End





How to operate the Touch Battle Bot

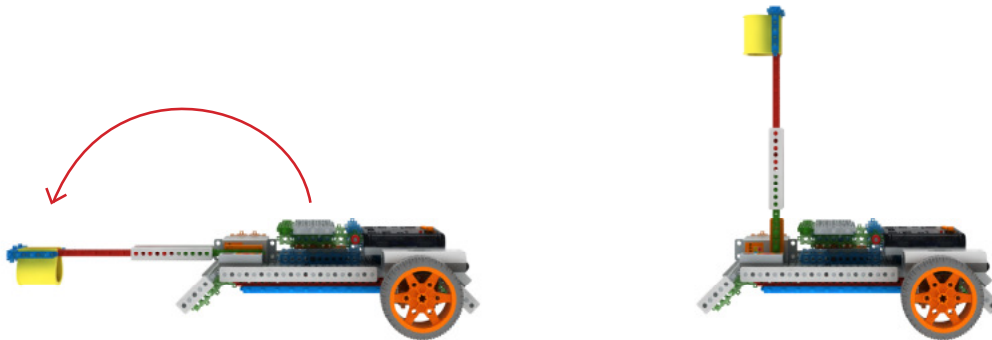
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.
6. Connect Touch sensor to IN1 of INPUT connector.

Motion Pattern/Program

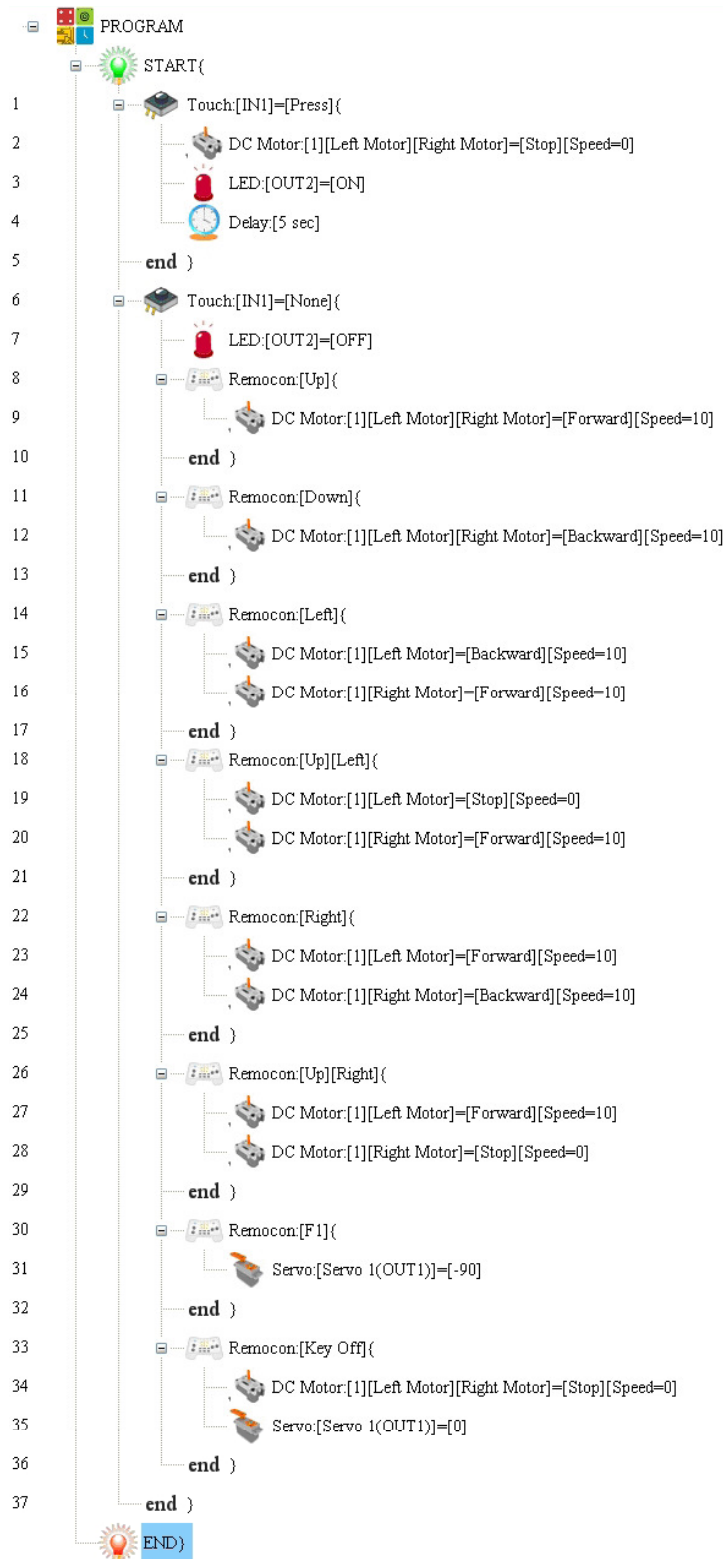


※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

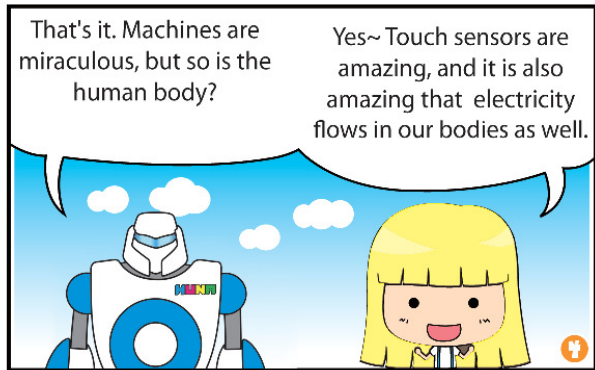
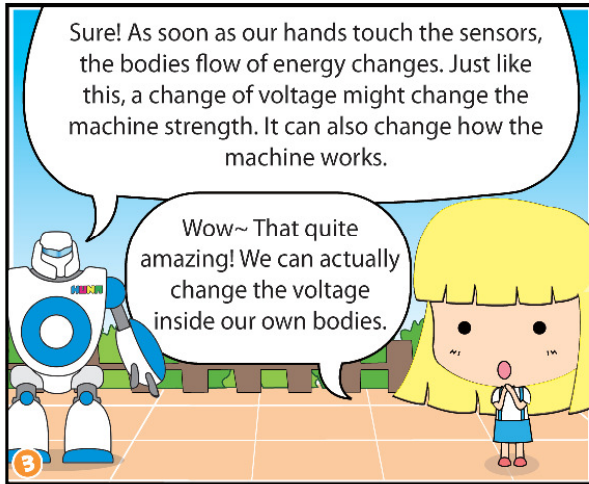
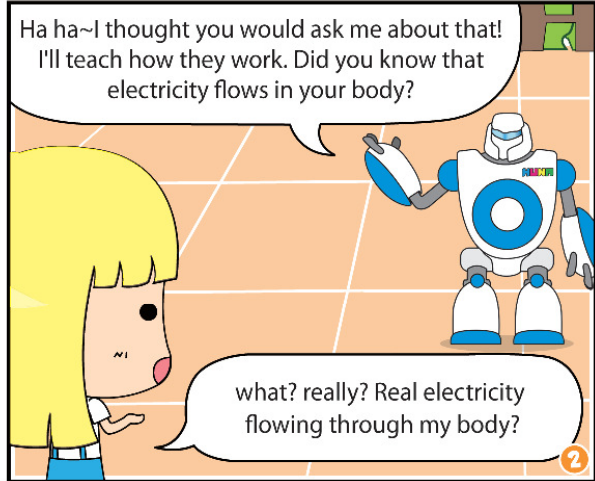
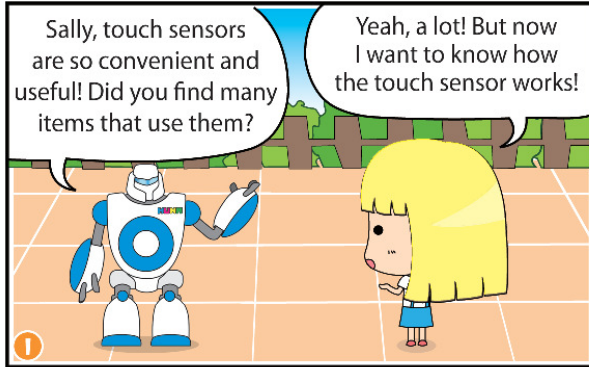
Program Example





Technology

STEM 6. How does the touch Sensor work?



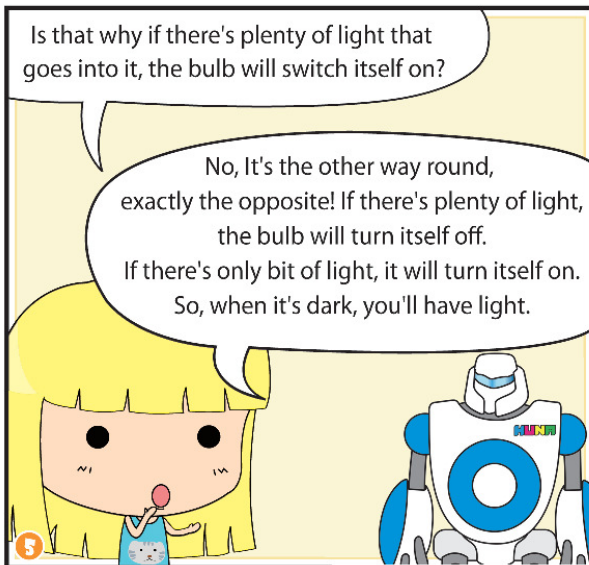
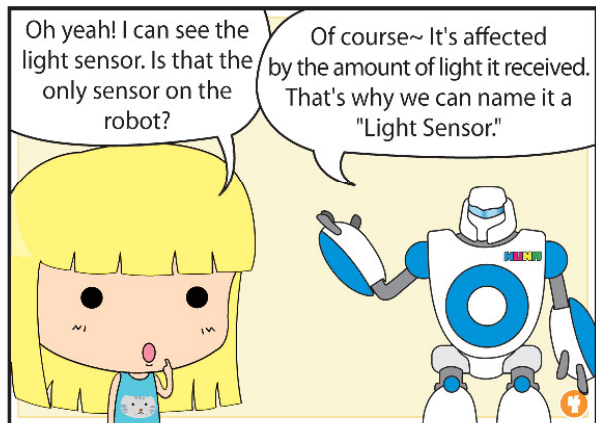
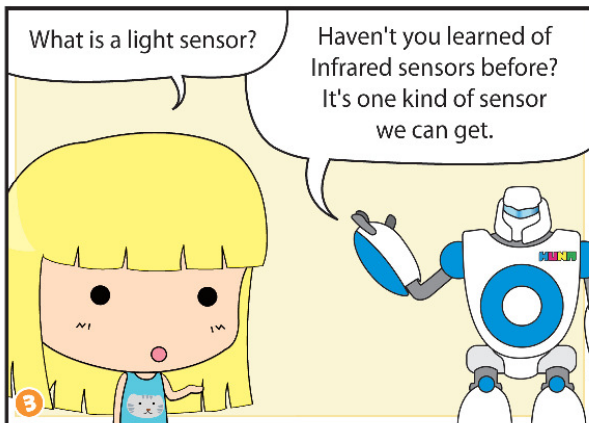
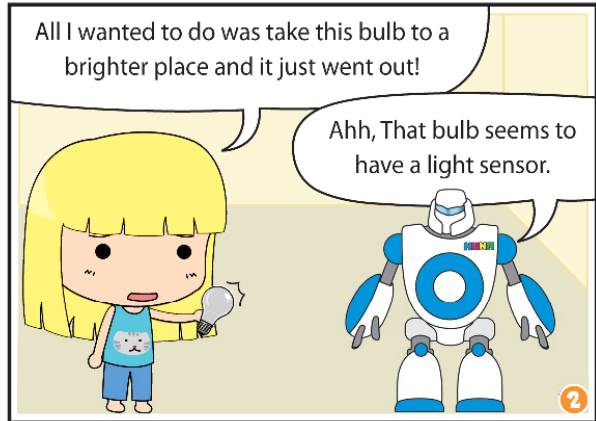
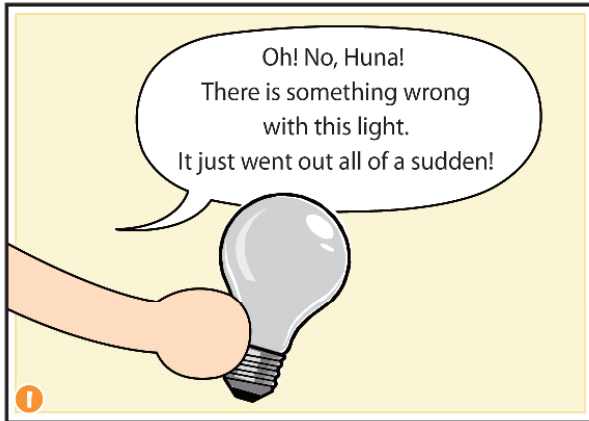
What other electrical equipment has touch sensors?

Spiral notebook area with horizontal lines for writing.

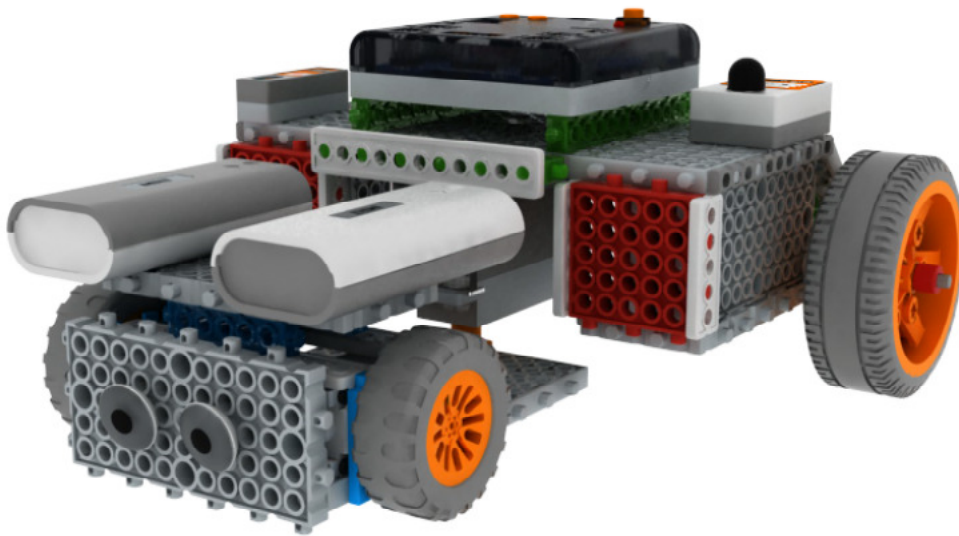


Science
Technology

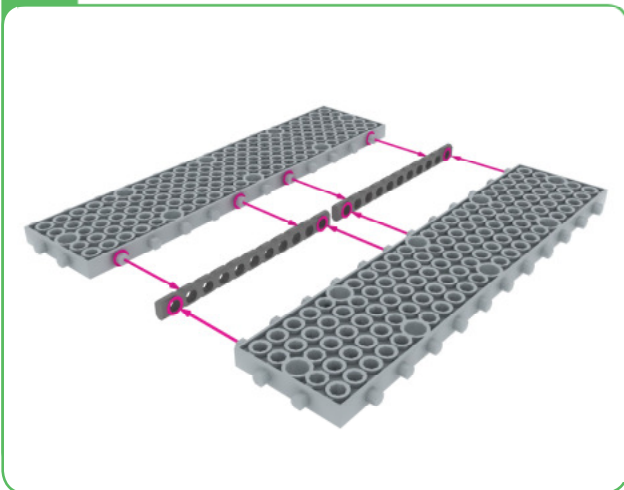
**STEM 7. The robot's eyes
-The light sensor**



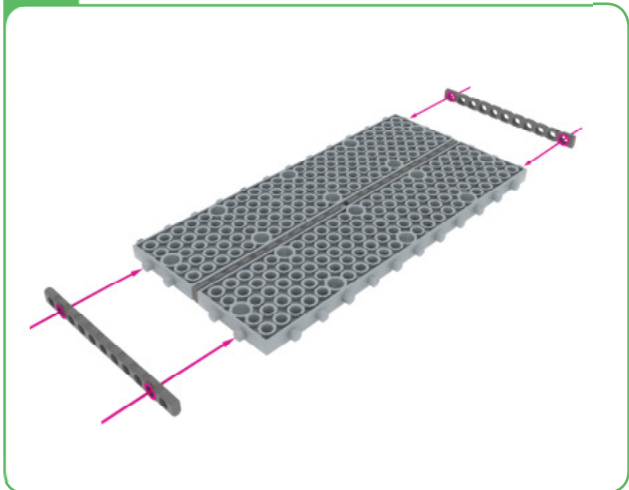
T Technology **Robot Making4-The Little**
E Engineering **Car "Bumboo"**



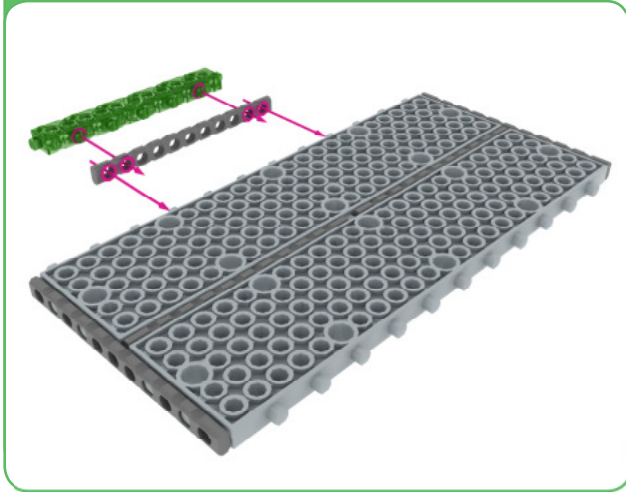
1



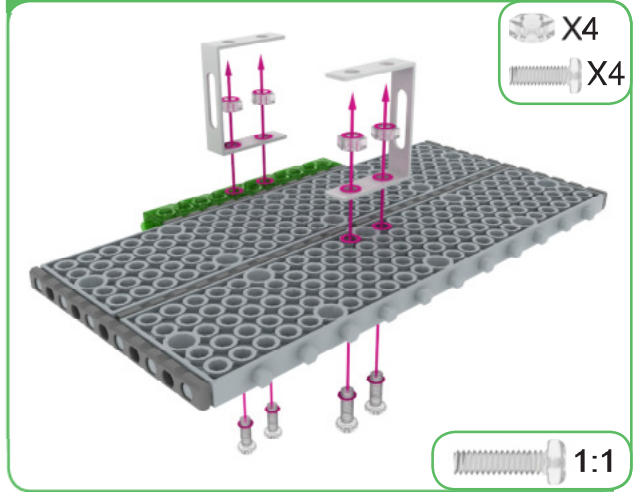
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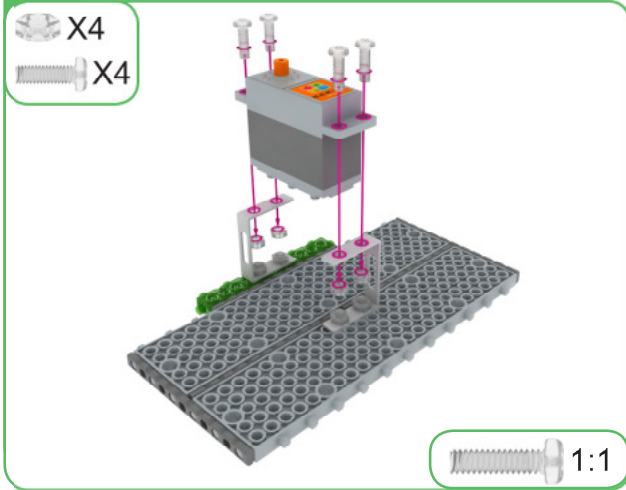
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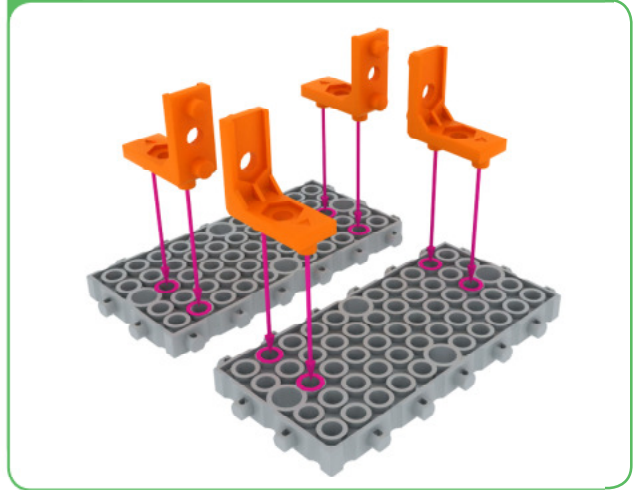
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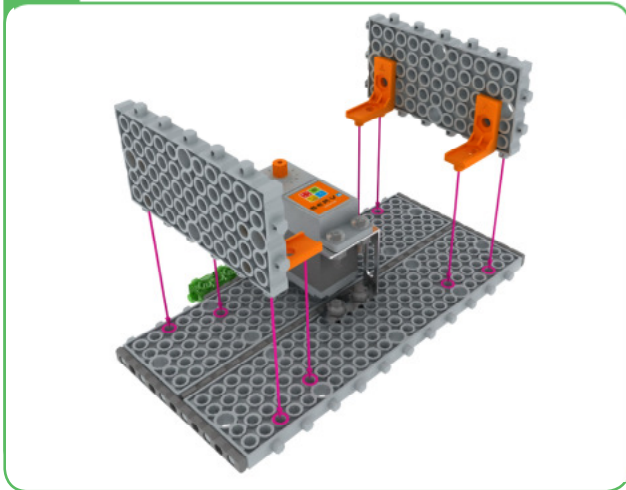
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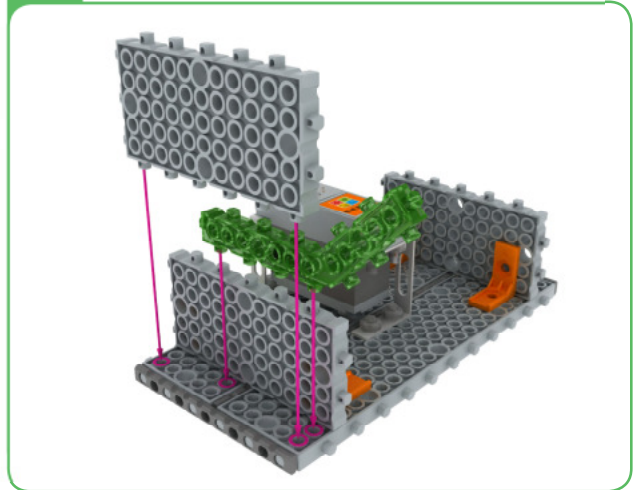
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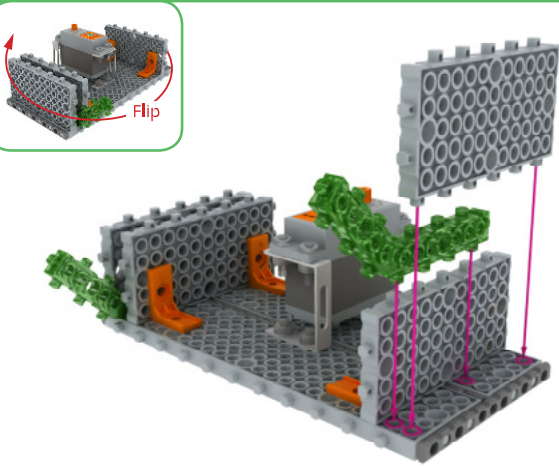
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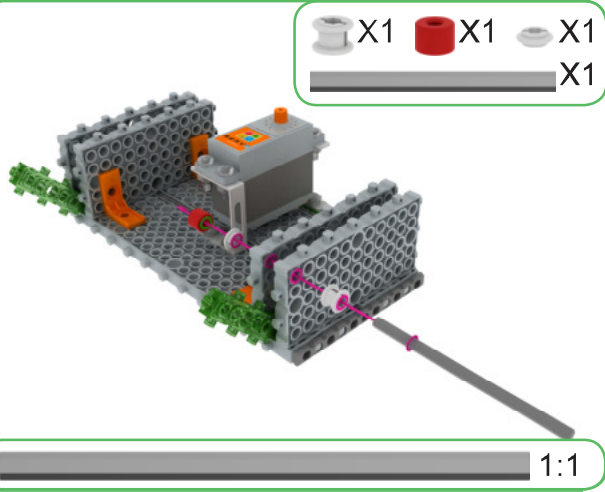
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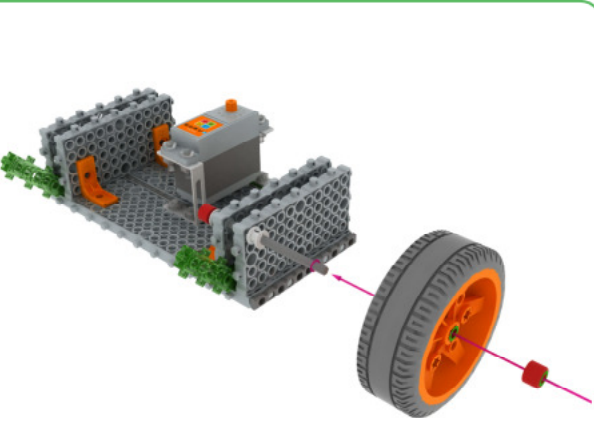
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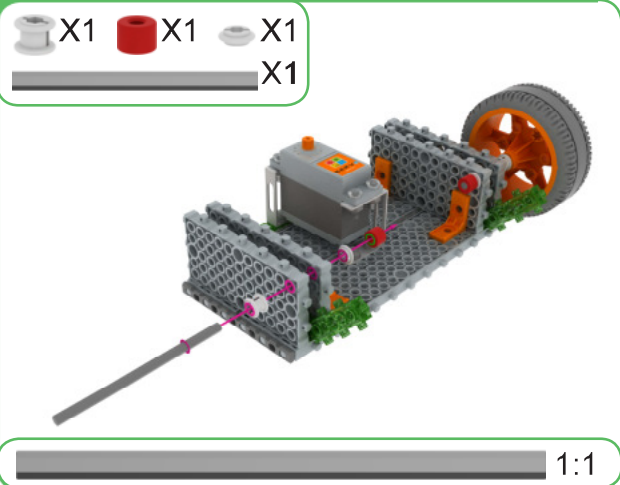
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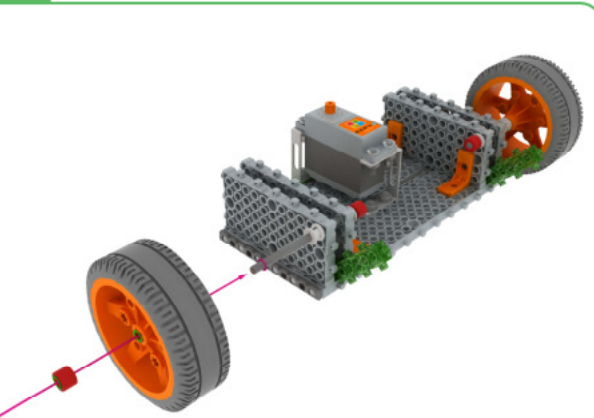
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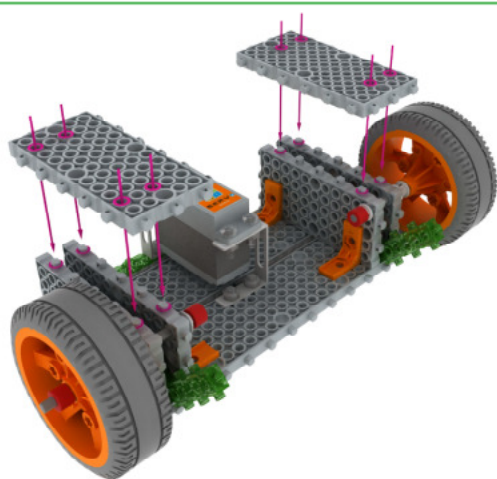
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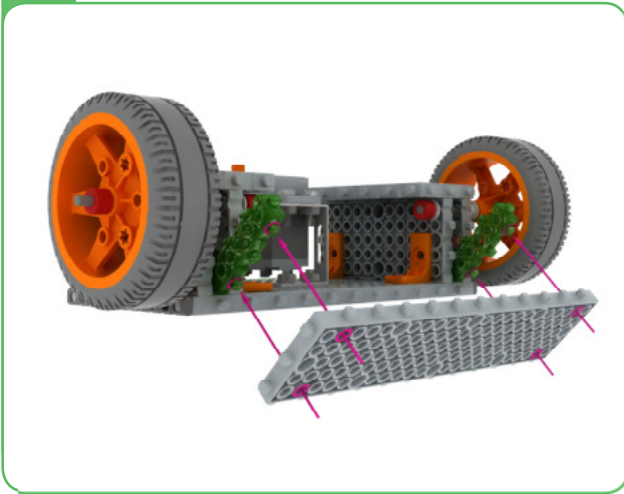
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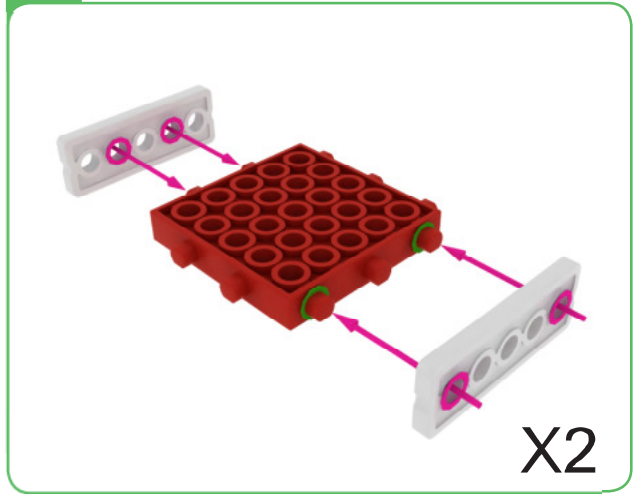
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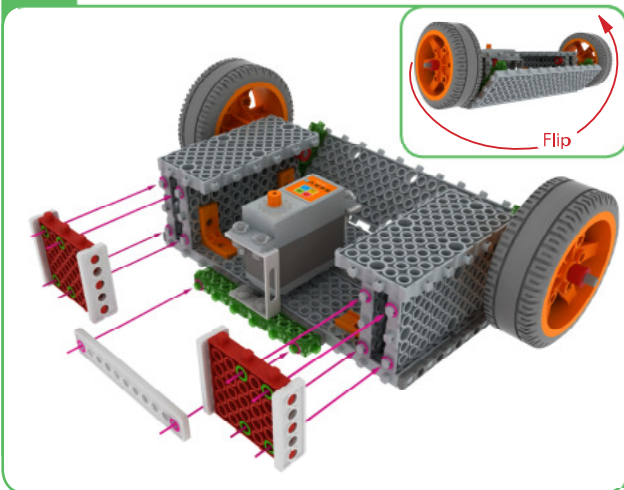
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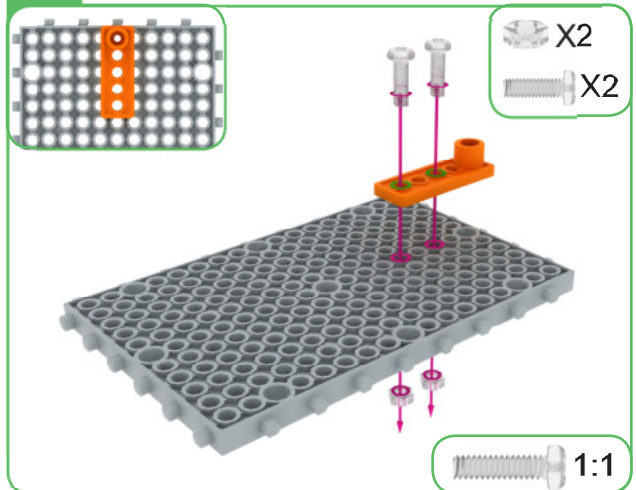
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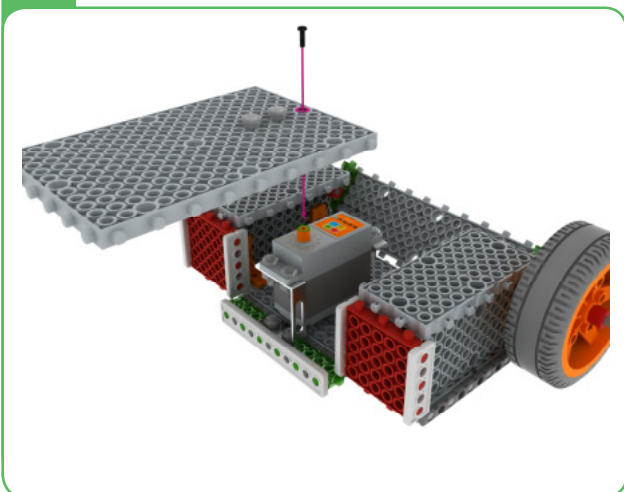
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18



19



Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

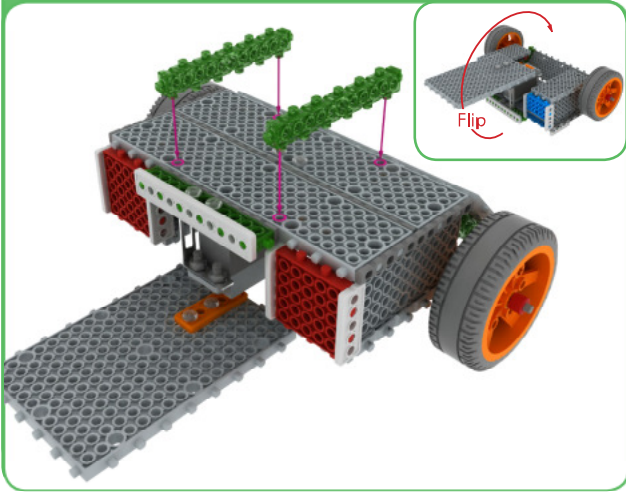
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PROGRAM
START{
  Servo:[Servo 1(OUT1)]=[0]
END}
    
```

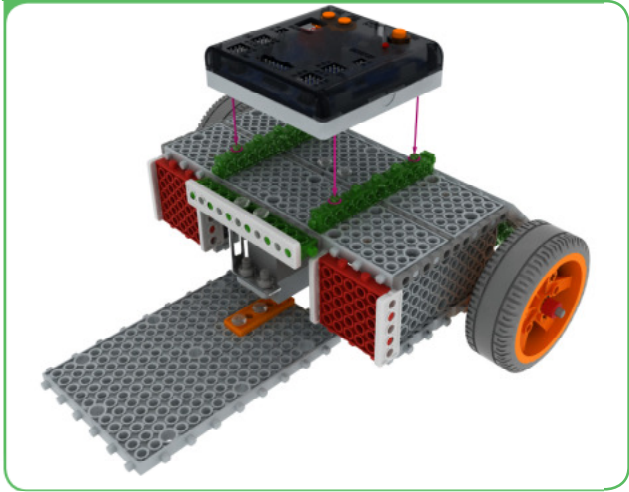


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

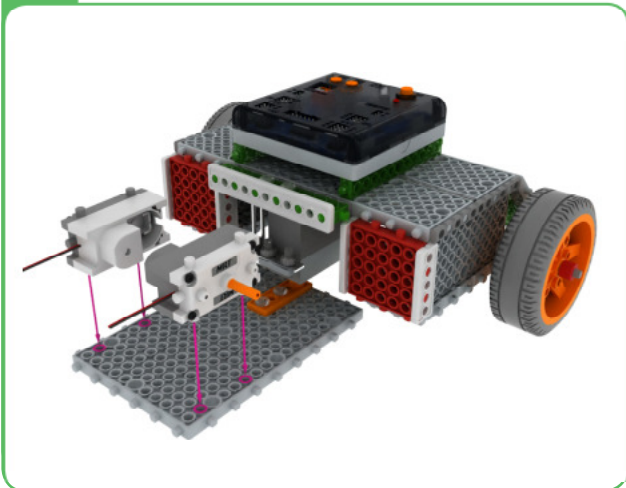
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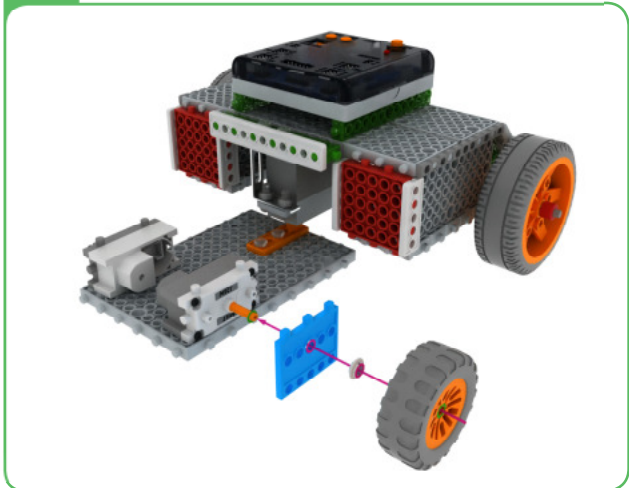
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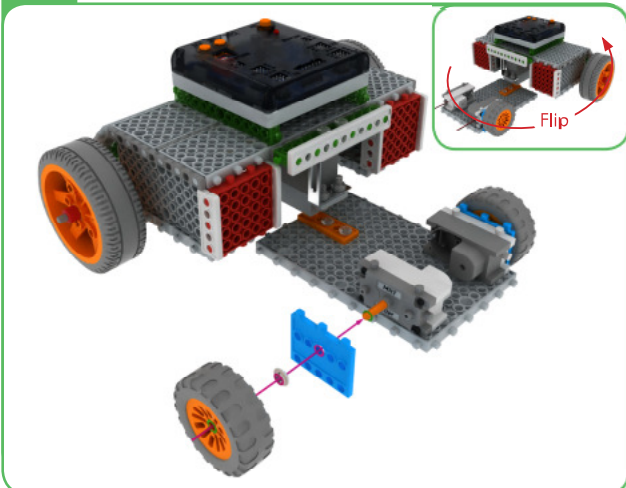
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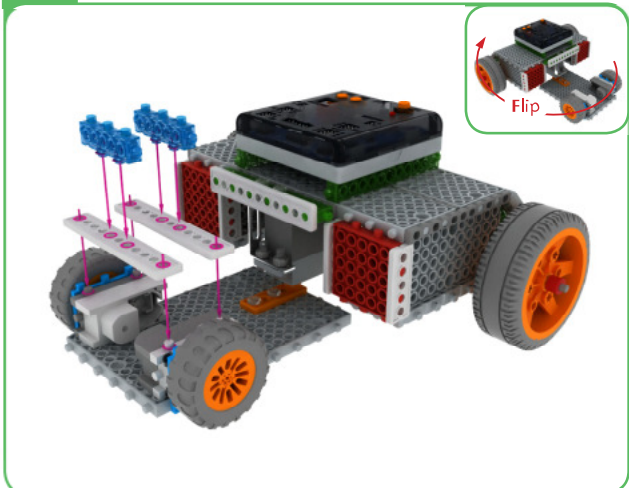
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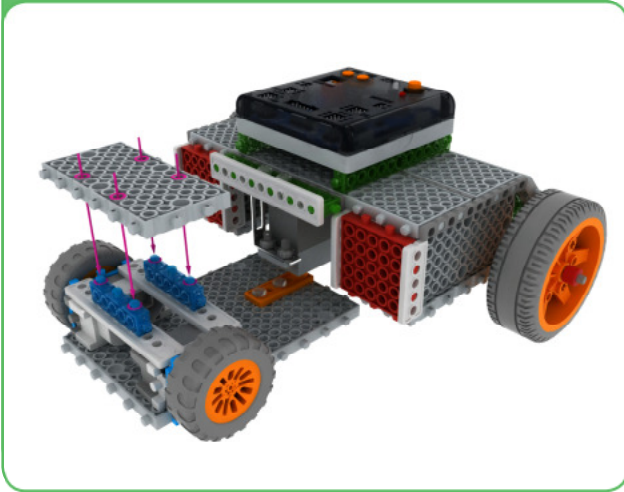
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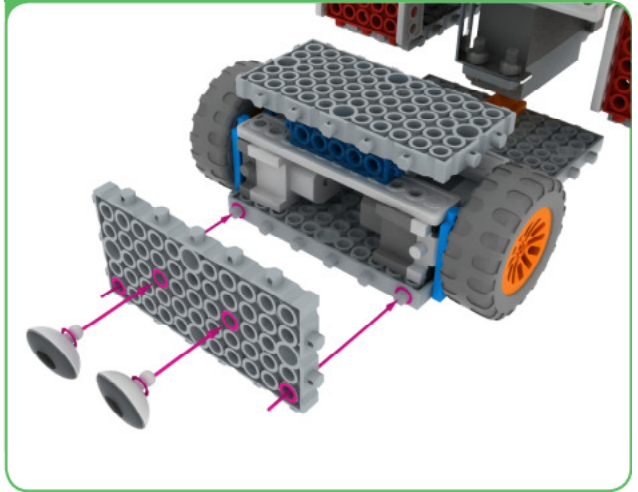
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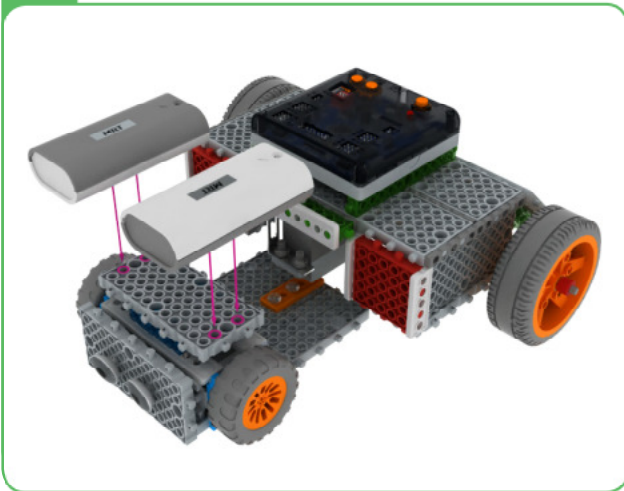
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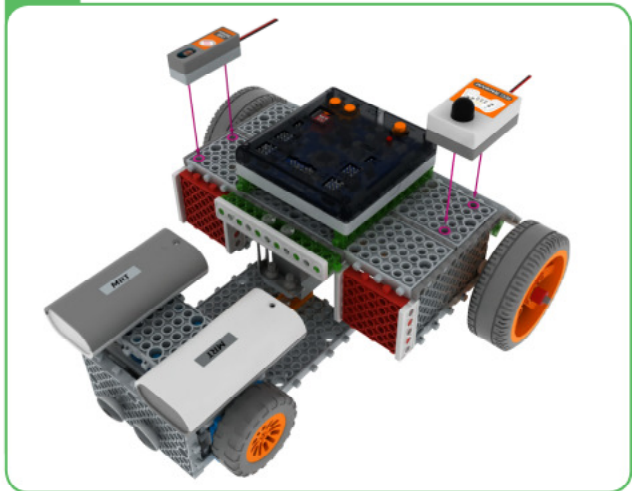
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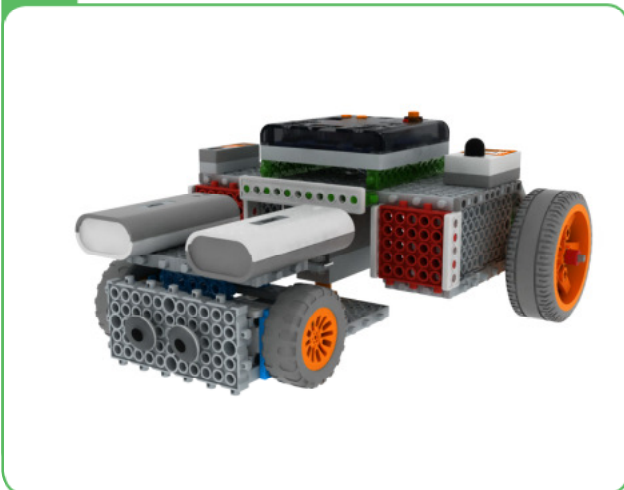
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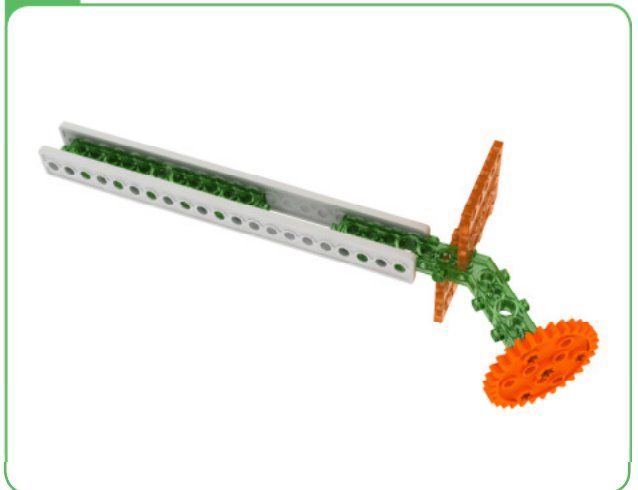
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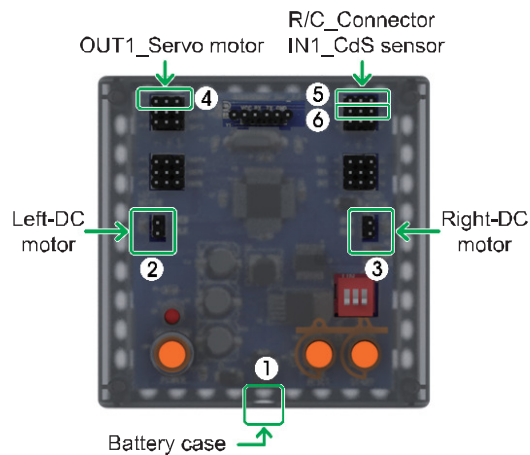
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How to operate the Little Car "Bumboo"

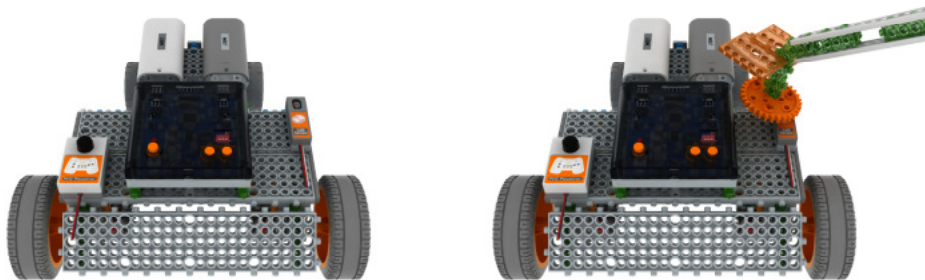
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.
6. Connect CdS sensor to IN1 of INPUT connector.

Motion Pattern/Program



- Hint 1. Speed is slow at ordinary time
Hint 2. Up the fragrance of flower can make it speed up

※ - Using the motion patterns as reference, let's write the program.

Program Download

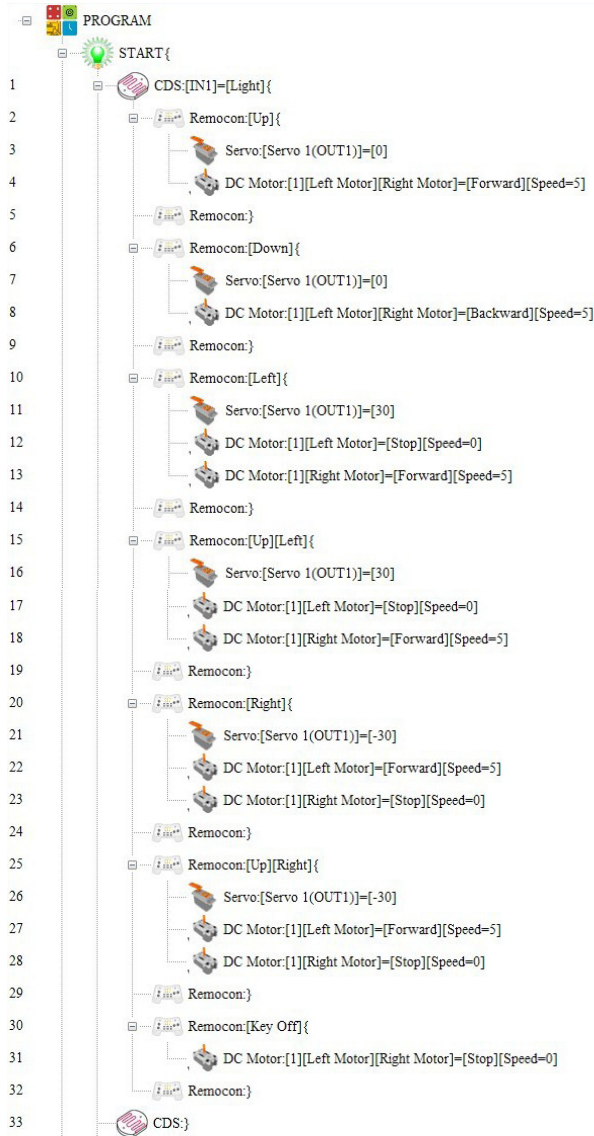
1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)



Can you make your robot run normally? can be flexible change of direction ?
What is the problem?
Consider together with your teacher and classmates ,then good finish your robot.

Hint. center of gravity (try to change the place of battery pack.)

Program Example





Science

STEM 8. Fossil Fuels, they are ancient

Panel 1: HUNA: Oh~ Harry, are you reading? what are you reading about?
Harry: It's a book about fossil fuels, and how they were created millions of years ago.

Panel 2: HUNA: I thought you would be interested in fossil fuels after our previous conversation.
Harry: I'm gonna tell you all about it.

Panel 3: HUNA: Really? You can get started right now!

Panel 4: Harry: Ok! Let's start with coal! Millions of years ago, plant got buried under soil. But over the years, more and more soil accumulate over the buried plants. Because of the weight of the soil, the pressure and heat of the buries plants increased. and so the very nature of the plants started changing. So for millions and millions of years, the soil put tons of pressure on these plants.

Panel 5: HUNA: Wow, that's a long time. So because of this pressure, the body of the plants compress, and it changes to a flammable stone?

Panel 6: Harry: Just like that! The next thing I'll teach you is petroleum. It's the oil of animal bodies that has been buried and decaying underground for a long time.
HUNA: But, that is what we call original or crude oil. Once this has been refined, it's petroleum.

Panel 7: Harry: And finally, natural gas! It's not that complicated. Fortunately, we use gases that are found underground as energy source. Because they come from underground, they are called natural gases.

Panel 8: Harry: So, Huna, what do you think of my hard work?
HUNA: Haha, I think you did well, because you taught me a lot of new things today!



Science
Technology

STEM 9. Let's talk about LED

Hey Huna! There is a small light bulb attached to my robot eye. Wow, my robot eyes are blinking!

Oh, those are LED bulbs! we say LED, but it actually stands for light emitting diodes.

1

LED? what's a light-emitting diode? What is it ...? it's such a difficult word....

Wait! Let me explain! If an electrical current would flow into the space where steel the two metal ends meet, the LED will emit light.

As far as we know, most electronic goods use LEDs for the indication of number and letters.

2

What are the advantages of using LED?

If energy A would change into energy B, the particles of energy A will disappear. So energy B will be less than energy A.

But LED's convert electric energy into light energy. Because of this, we can save more electric energy. No electric energy is wasted.

3

And it better for the environment as well. because it doesn't use mercury. Mercury causes much of the world's pollution.

WOW~ I'm really impressed with LED. I want to know more.

4

Well, LEDs are small. But the period of their lights brightening is quite long. And LEDs have various colors!

There are other colors? If so, I want to change the color of robot's eyes.

5

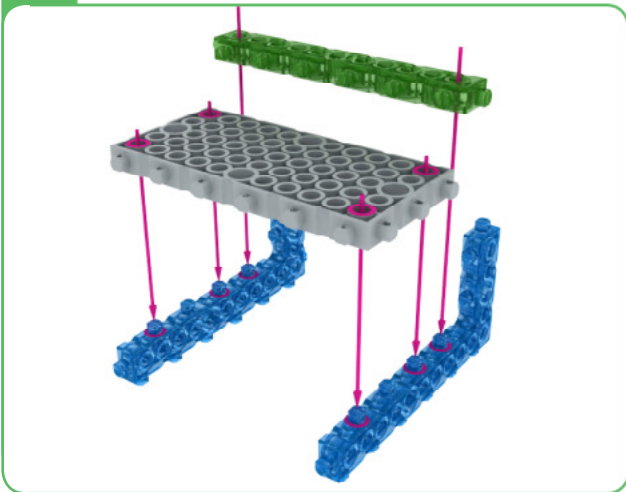


Engineering
Art

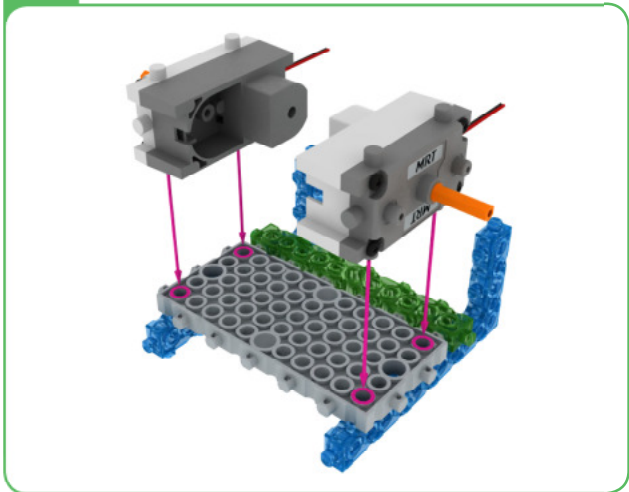
Robot Making5-Fencing Robot



1

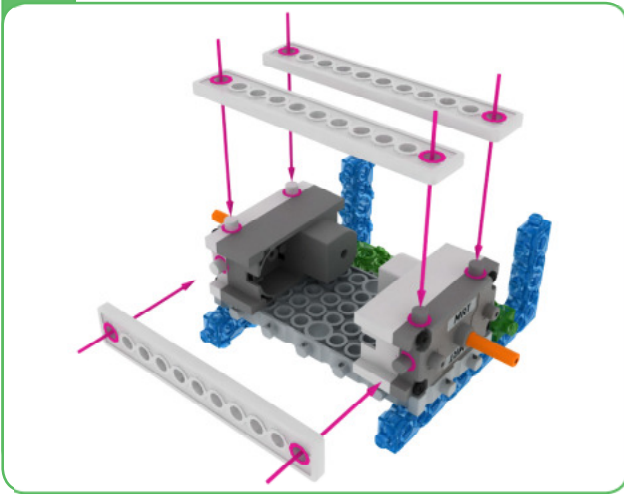


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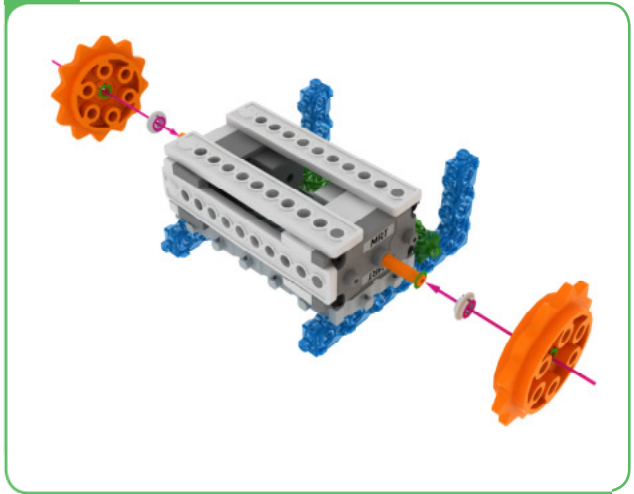


MY ROBOT TIME

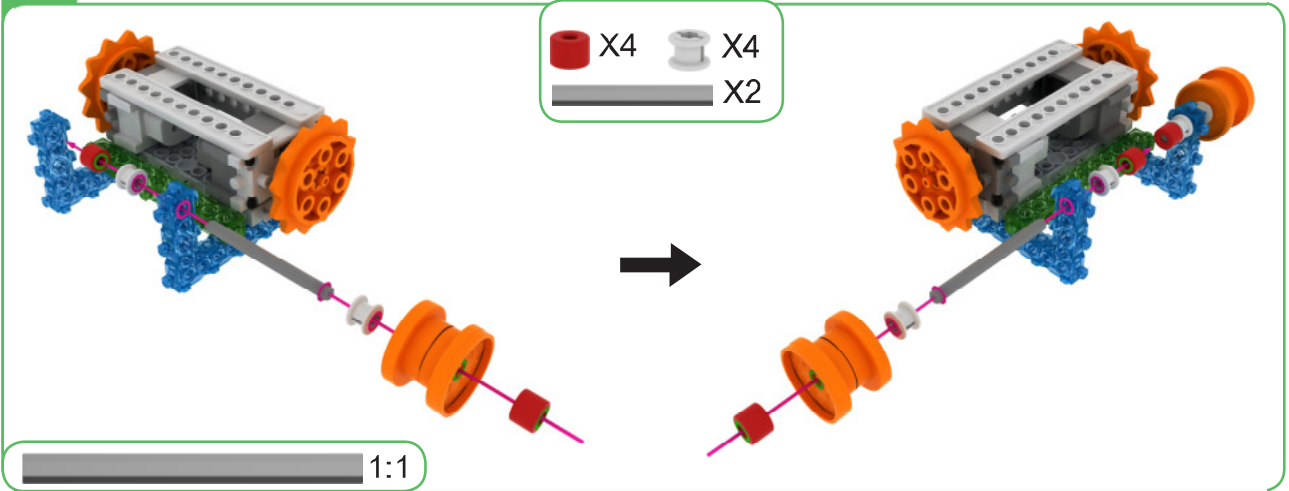
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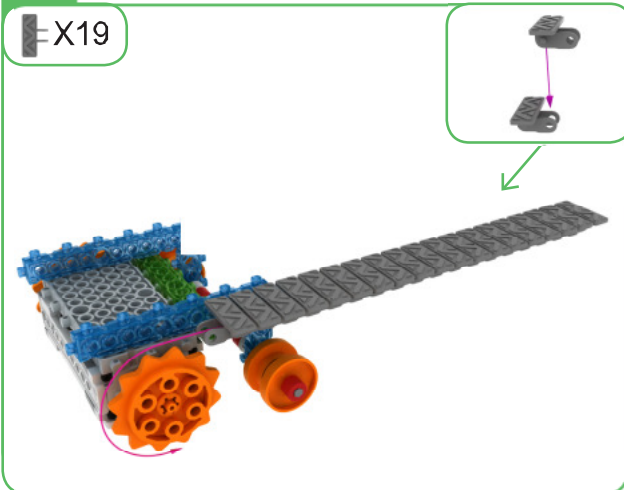
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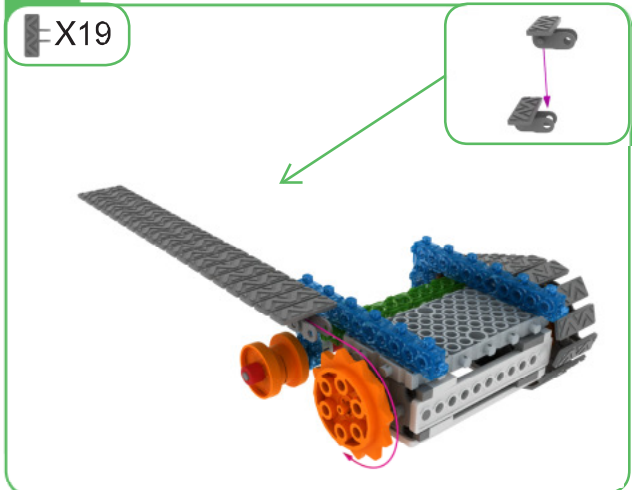
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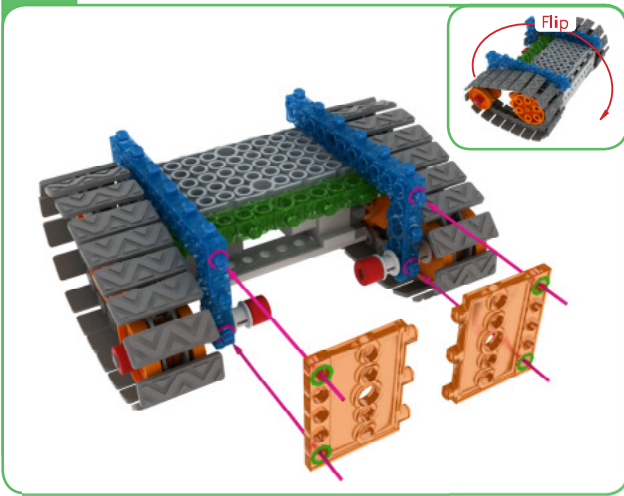
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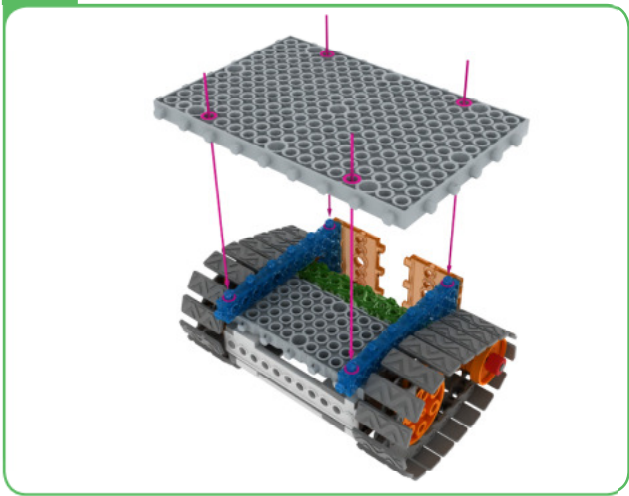
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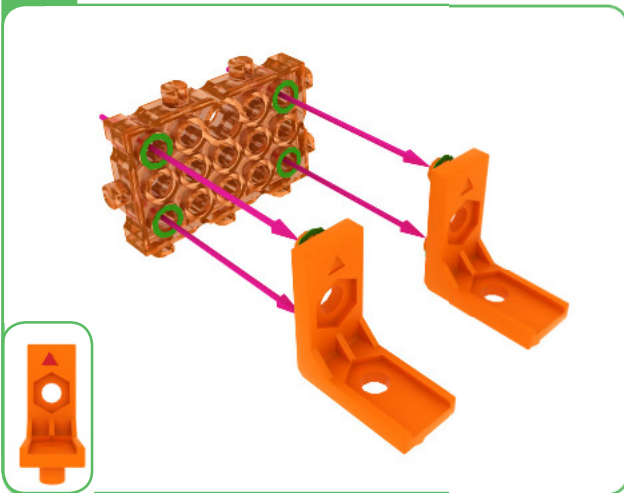
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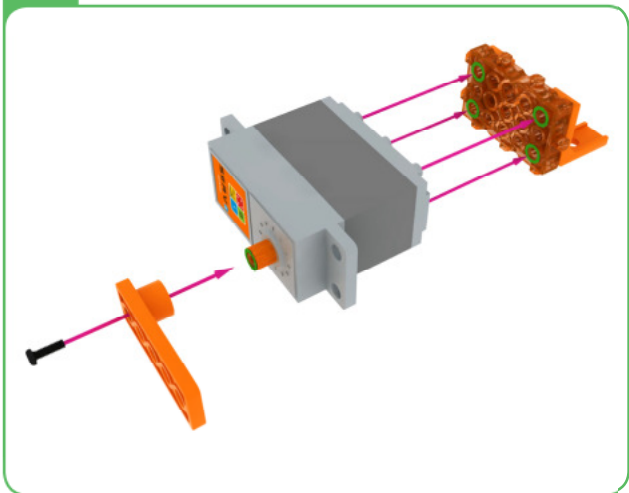
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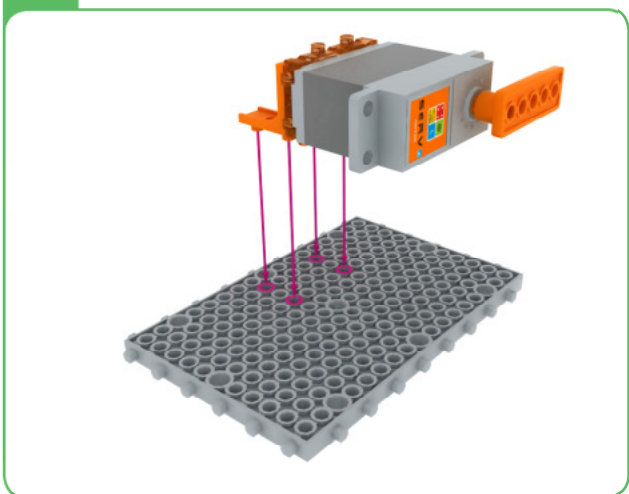
Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

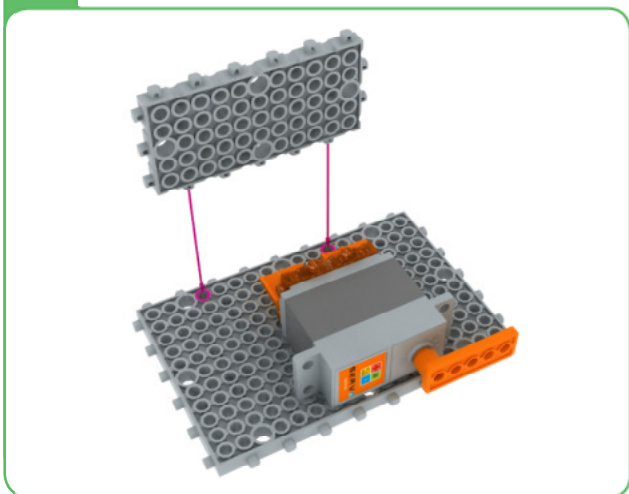


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

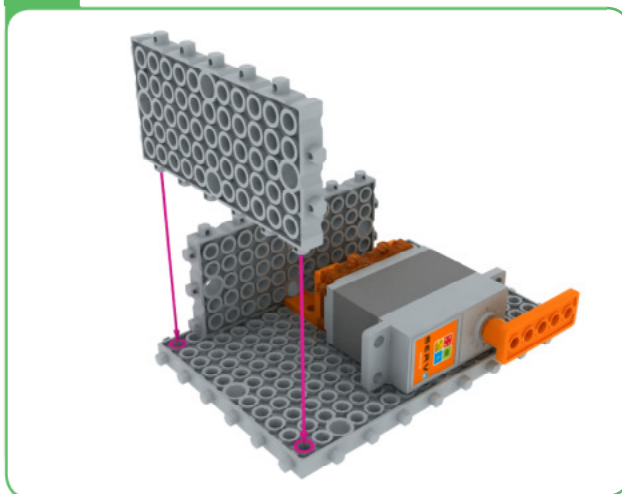
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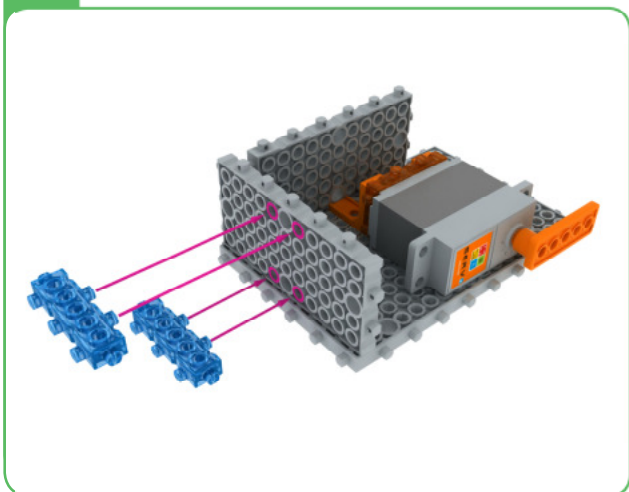
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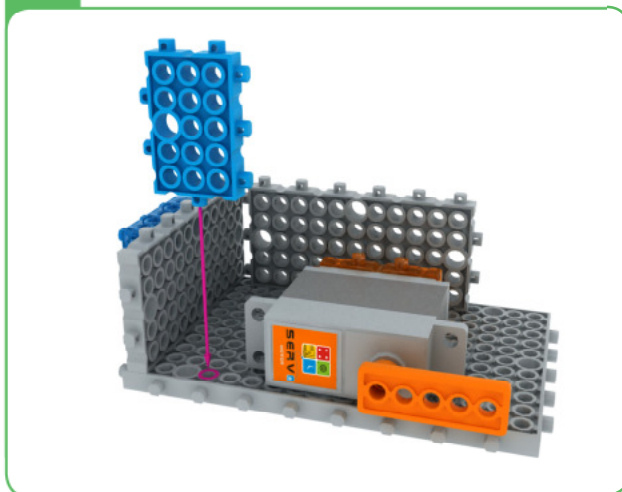
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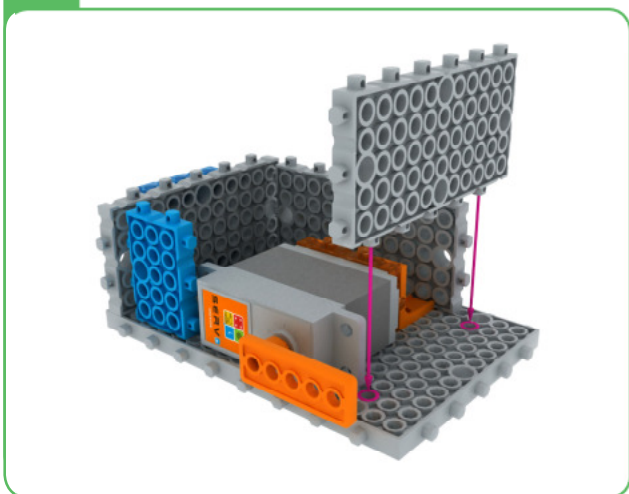
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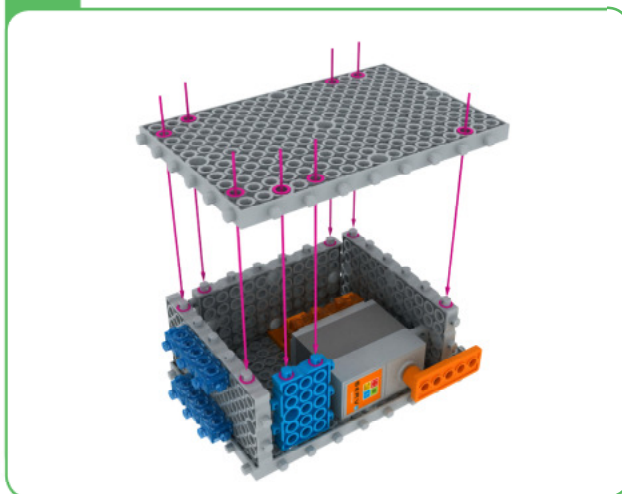
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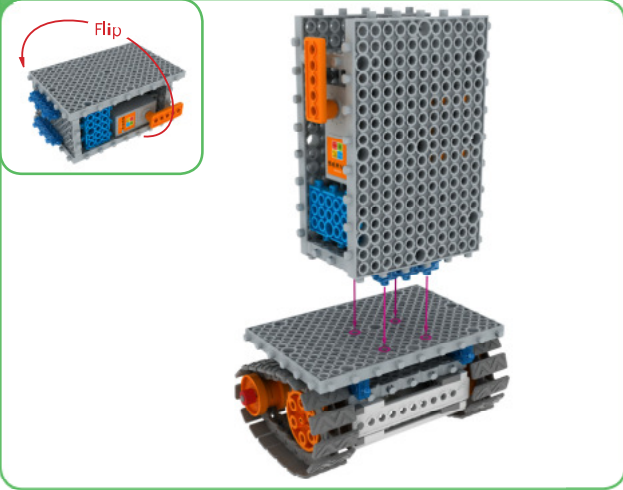
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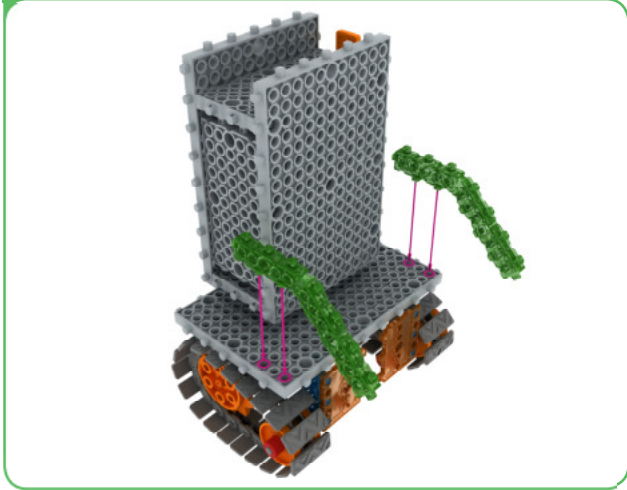
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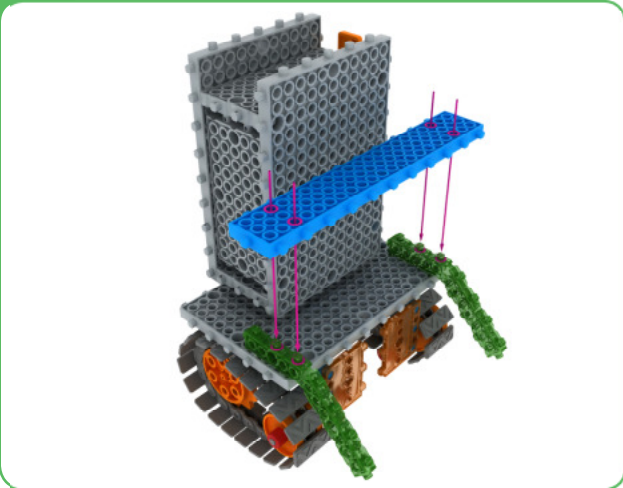
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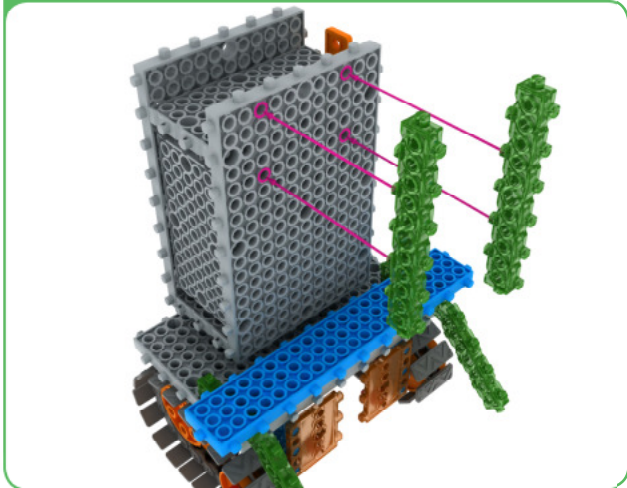
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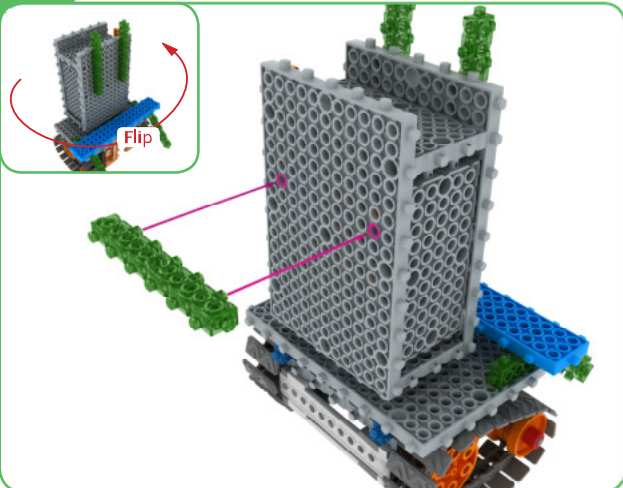
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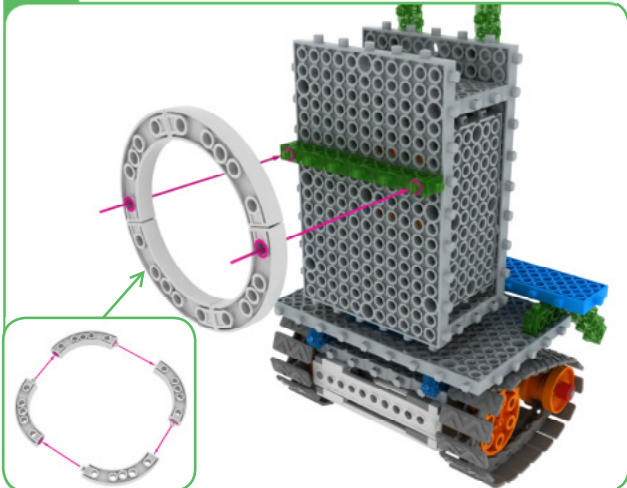
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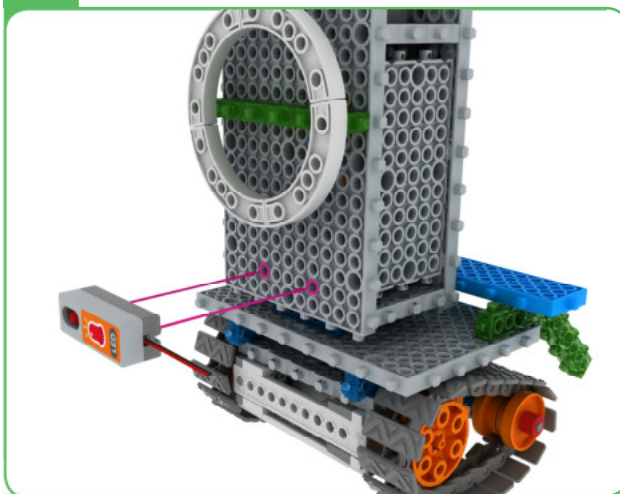
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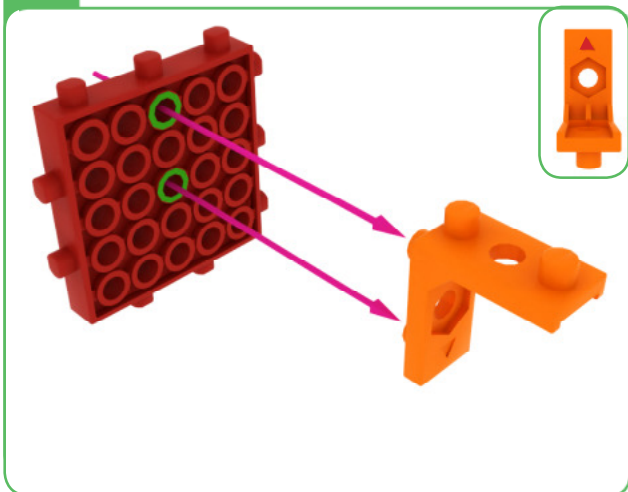
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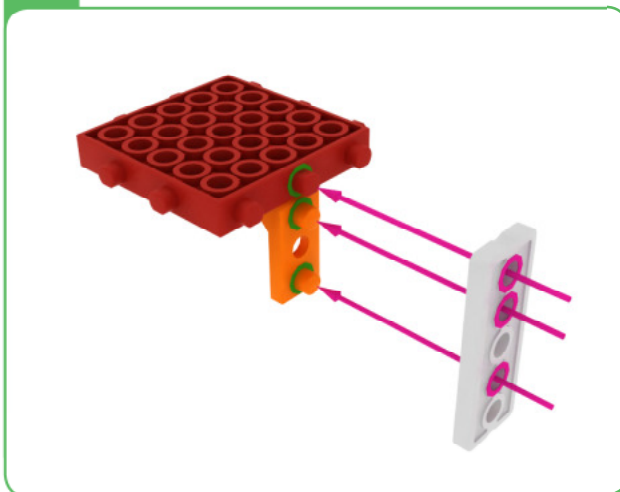
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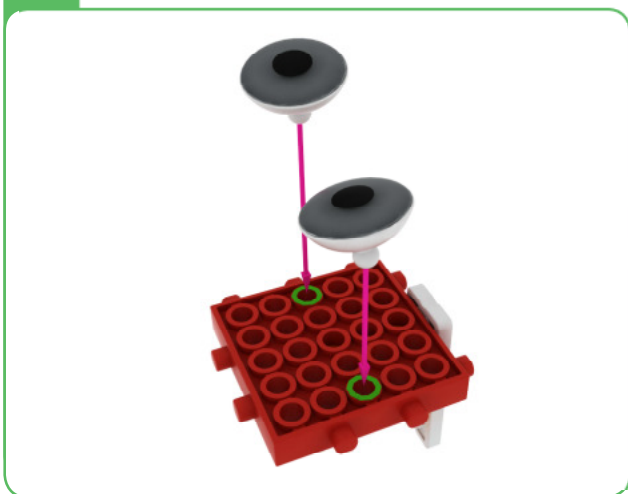
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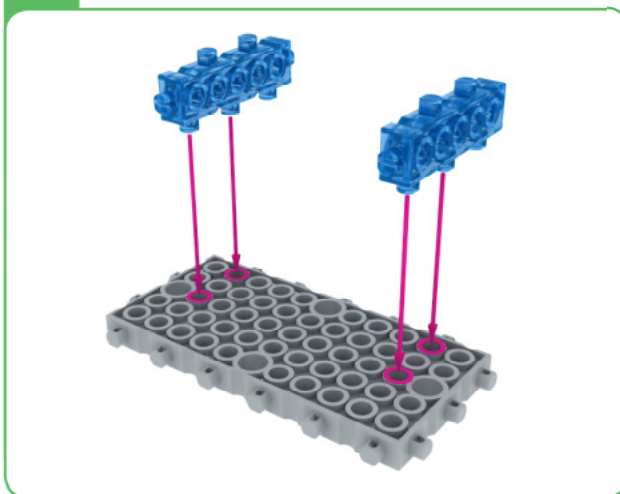
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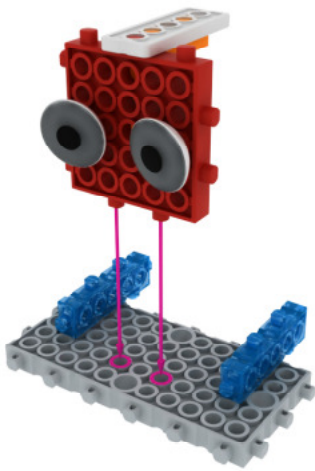
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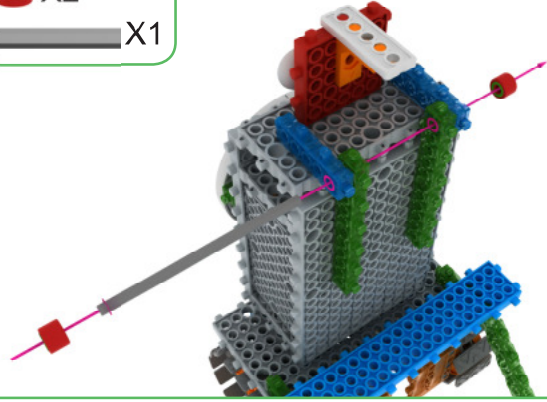


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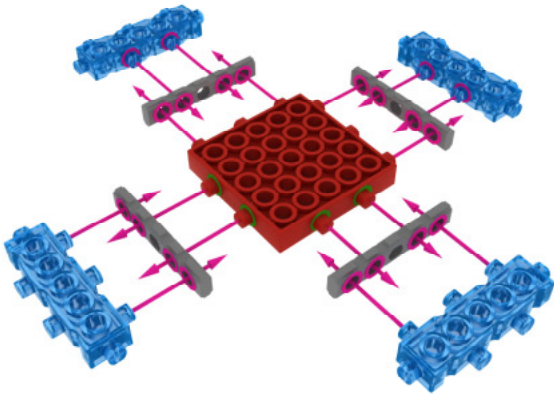
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■ X2
— X1

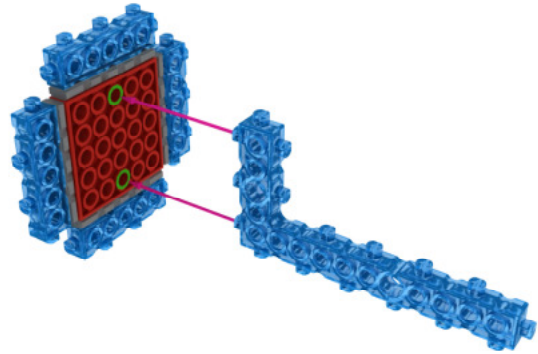


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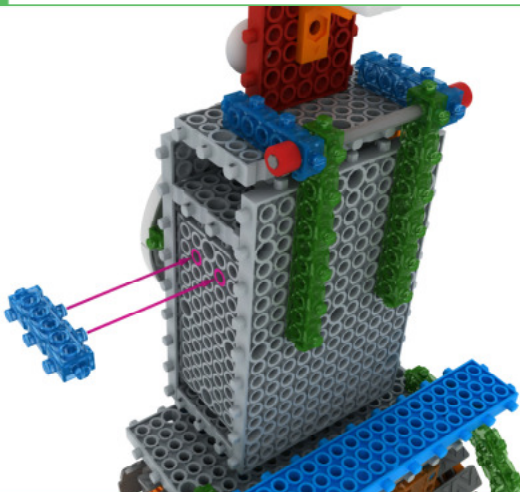
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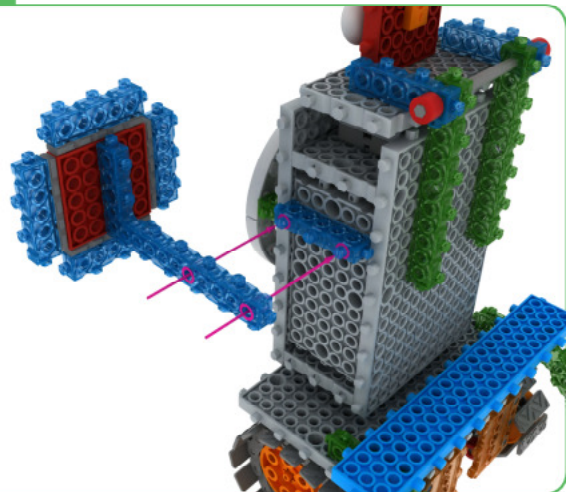
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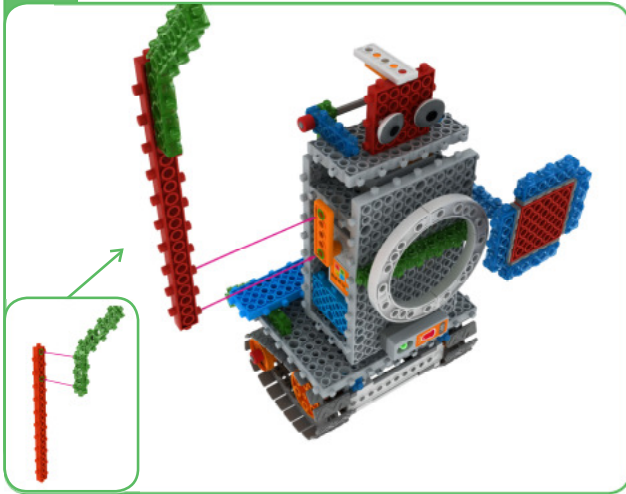
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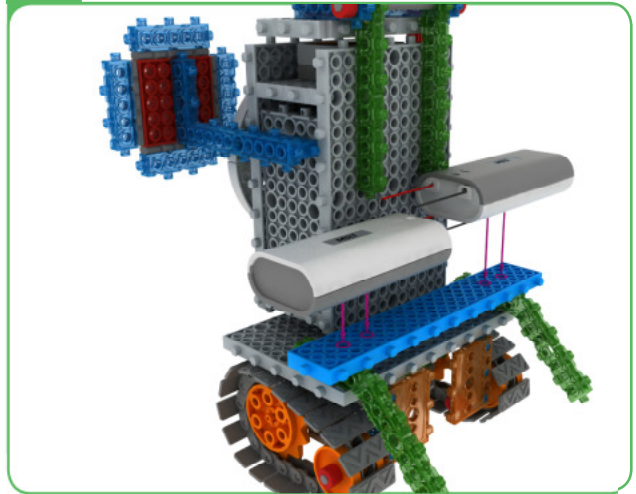
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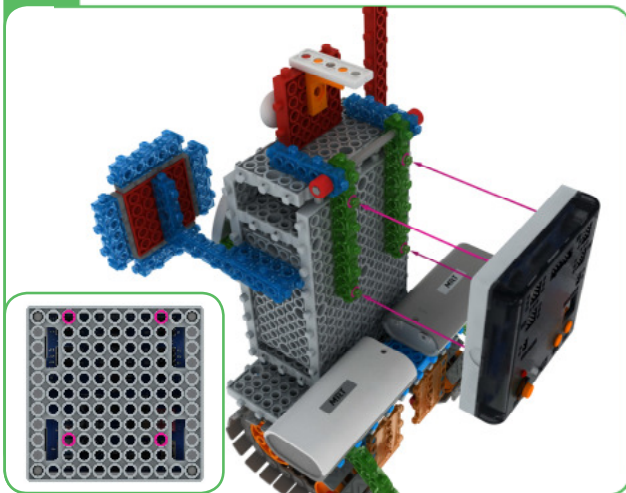
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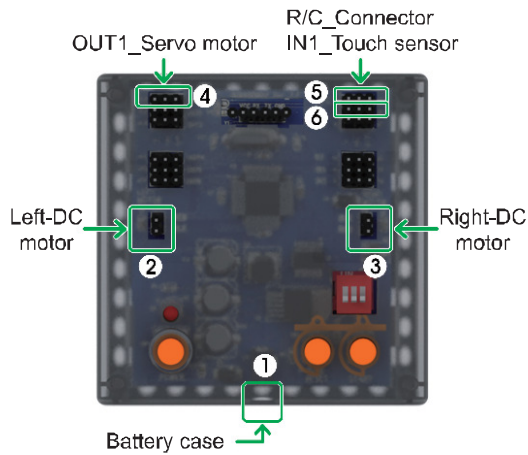
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How to operate the Fencing Robot

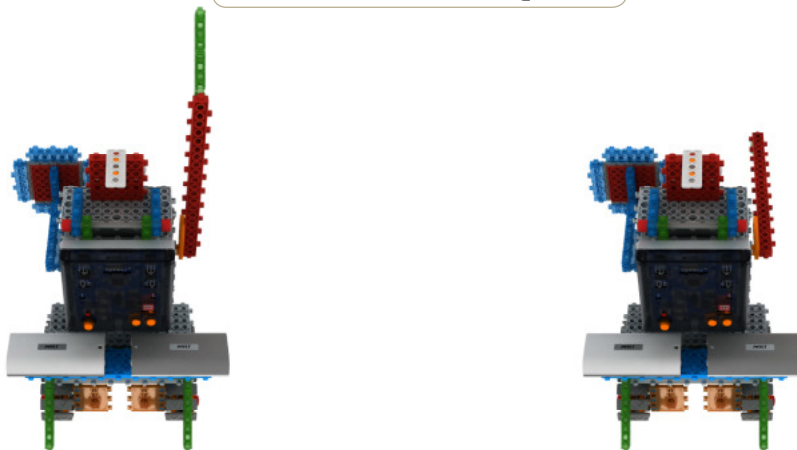
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.
6. Connect Touch sensor to IN1 of INPUT connector.

Motion Pattern/Program



Hint 1. Servo motor attack.

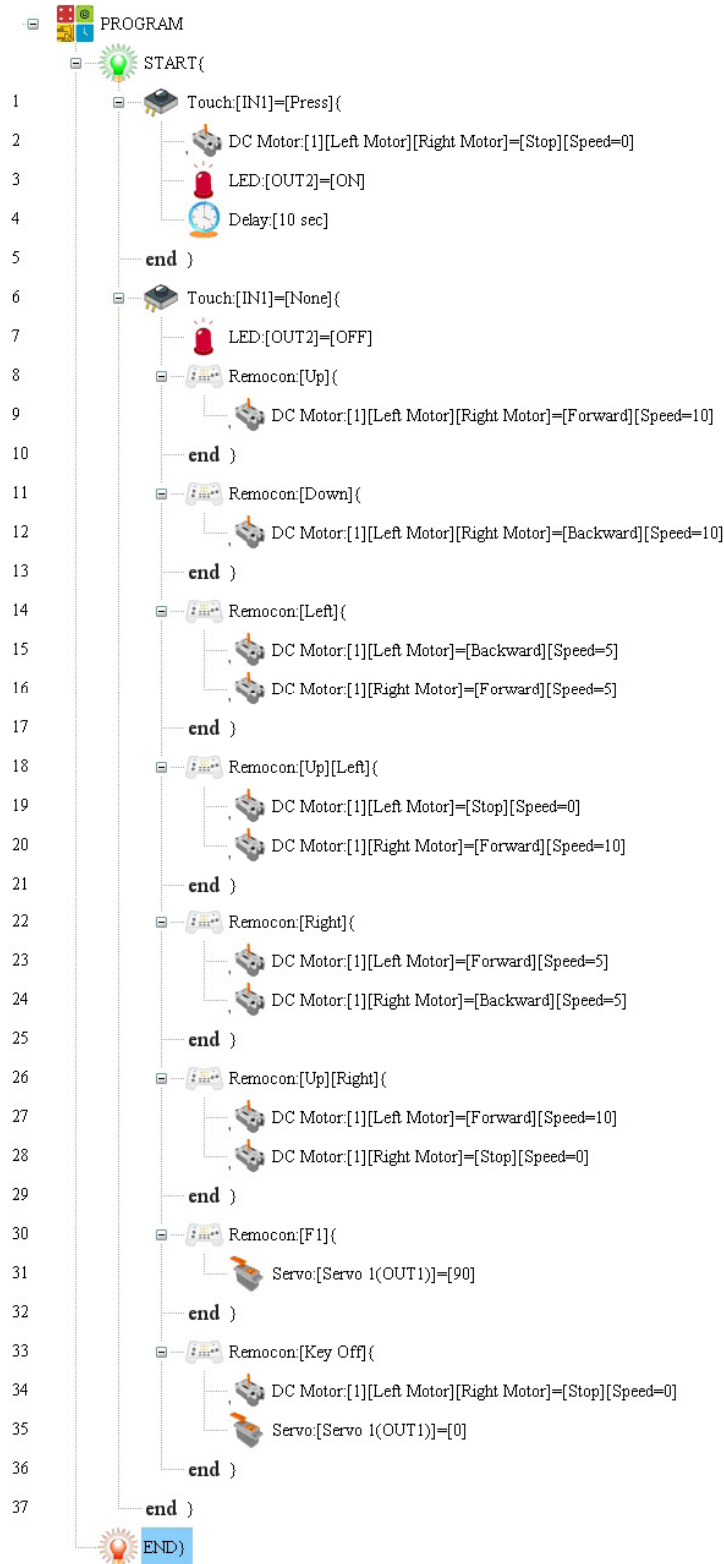
Hint 2. Touch sensor will temporarily stop 10 seconds after sensed signals.

※ - Using the motion patterns as reference, let's write the program.

Program Download

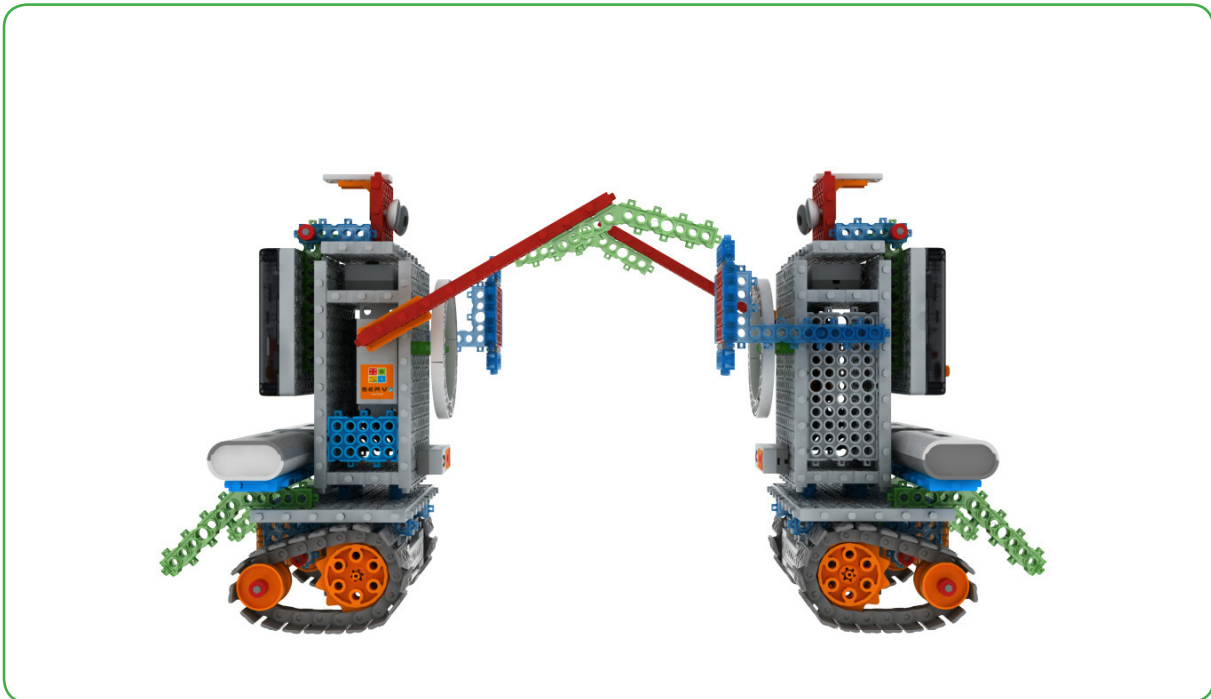
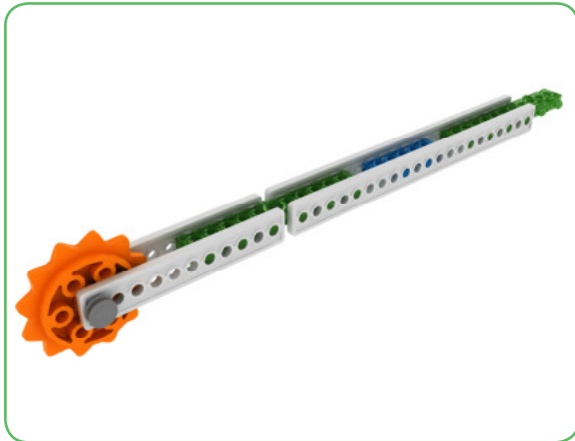
1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

Program Example



 **Engineering Art** *Let's make interesting games with Fencing Robot*

Make My weapon(Fencing)



When your attack to the other robot's head success,the other robot should be stopped 10 sec,after 10 sec,LED turn on and it moves again. Can you program your robot too? Two programmed robots make a fencing competition to attack the other robot's head.



Science
Engineering

STEM 10. It's really difficult to live without this-fossil fuels

1 Huna, I saw on the news, they are producing busses that use natural gas for fuel. what's the natural gas exactly?
I used natural gas when I went to school.

Wow! how was it?
Well, It's just other busses, except that it uses natural gas instead of oil.

How can natural gases be used instead of oil?
Oil, natural gas and coal are all fossil fuels. The problem is, when we use oil, we emit bad gases that pollutes the air.
..And does the natural gas bus cause/emits less pollution than the oil driven bus? So using oil and coal aren't good for the earth!

Well~ Oil and coal aren't always good. but until now, we have been able to live thanks to oil and coal.
Ah, really? how do we use oil and coal nowadays?
Did you know that our roads are made of one of oil's residues?

And we can keep warm in the winter because oil keeps the boiler working! And you won't believe it, there is even oil in the living things around us.
Really? It's not in our food, right?
No, no, no!! we use rubber everyday, and rubber has oil in it. For example, look at tires.

9 We use rubber quite often, don't we?

Yeah, in fact, we use it in everyday of our lives.

10 Then how about the other fossil fuels?

Coal is not popular these days. Because oil is easy and efficient to use, the popularity and the amount of coal used today are decreasing.

11 Really? so does that mean we'll never see coal again.

No, no, Have'nt you heard of the thermal power plants?

Yeah, they use it to produce electricity. Do they use coal there?

Yes, we have a lot of thermal power plants in my country as it cost less .

12 However, because it polluted the air so much, we had reduce the amount of coal we use in it.

Fossil fuels are convenient, but the great amount of environmental damage they cause is a big problem, right?

Yes, and the amount of fossil fuels are also decreasing rapidly! Fossil fuels aren't unlimitted.

13 Don't we have other ways to survive? Then how will we survive without it!

Don't worry! These days our smartest scientist are developing alternative energy sources that will replace fossil fuels.

Really? That's great news! These news energy sources won't produce environment pollution, right?

14

15

16



Science

STEM 11. The first law of motion-Inertia

Panel 1: In the bus. A robot says "Boong~".

Panel 2: The robot says "Kkeek~ Bump!". The boy says "Ugh!!!".

Panel 3: The robot asks "Harry, Are you ok?".

Panel 4: The boy says "I fell down because the bus stopped suddenly." The robot says "I feel sick! Why did we fall down while going forward?".

Panel 5: The boy asks "Why do you fall down to the front when a bus stops suddenly??".

Panel 6: The robot explains: "It's because of Inertia. Inertia is the first law of motion. The law states that moving object try to keep moving continuously. And Inversely, it keeps static things standing still continuously. So, what will happen if a bus stops suddenly?".

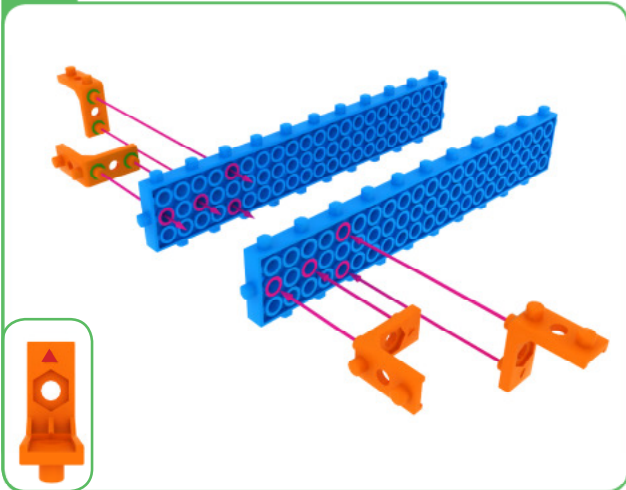
Panel 7: The boy says "The bus stopped, but my body kept on moving forward because of inertia. That is why I fell down." The robot says "Correct~".

Panel 8: The robot says "On the contrary, when a bus is trying to stand still, I'll move backwards because of inertia." The robot concludes: "From now on, when we ride a bus or in a car, we must fasten our seat belts, or hold on to something."

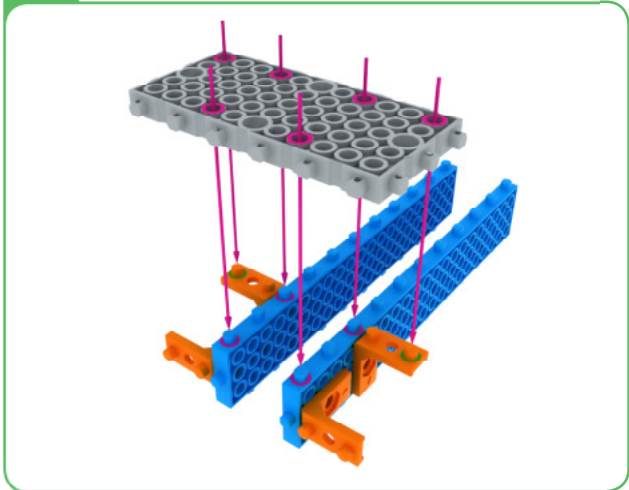
S Science
E Engineering **Robot Making6-Catapult**



1



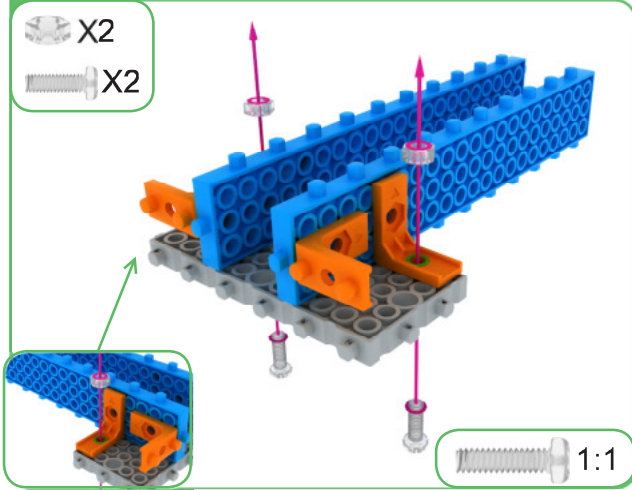
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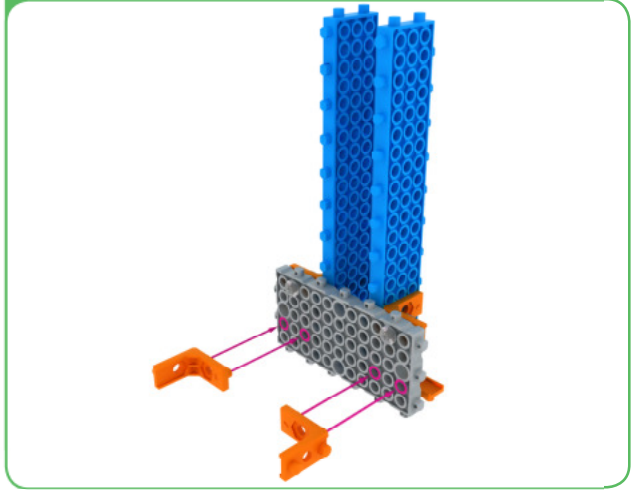
MY ROBOT TIME

3

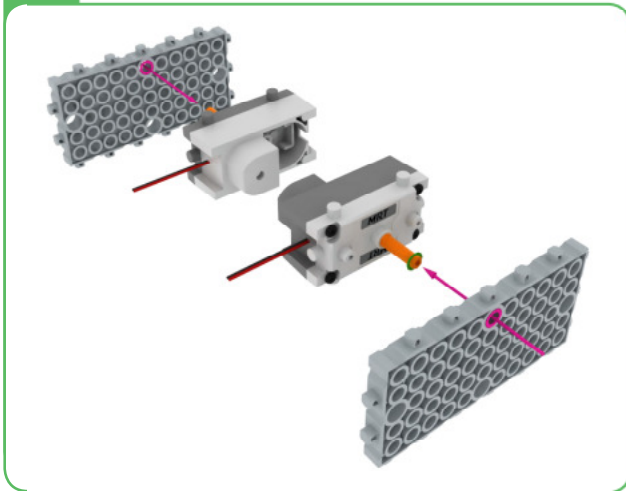
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- X2



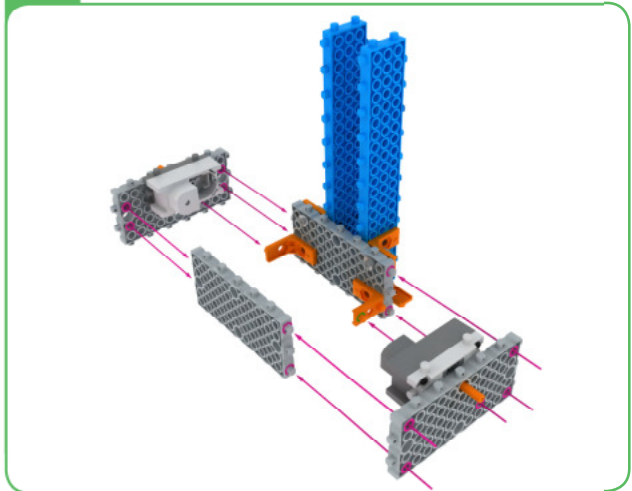
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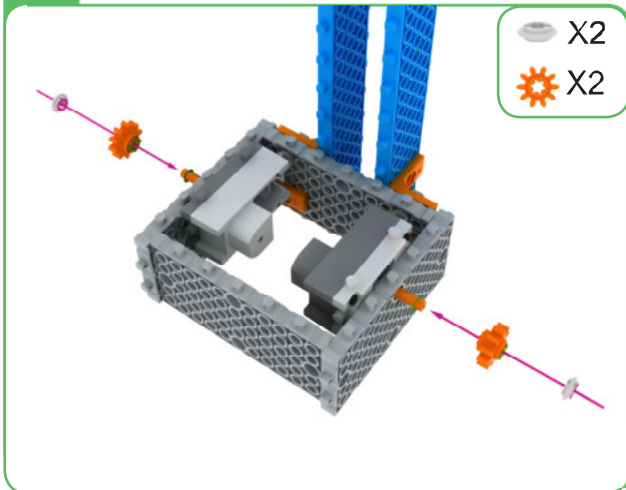


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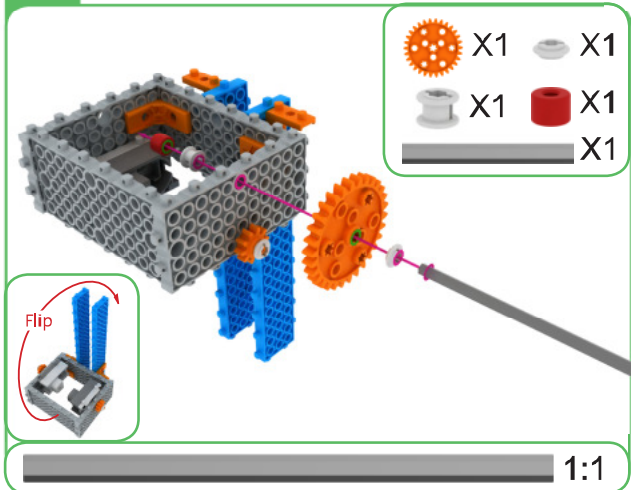
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- X2
- X2








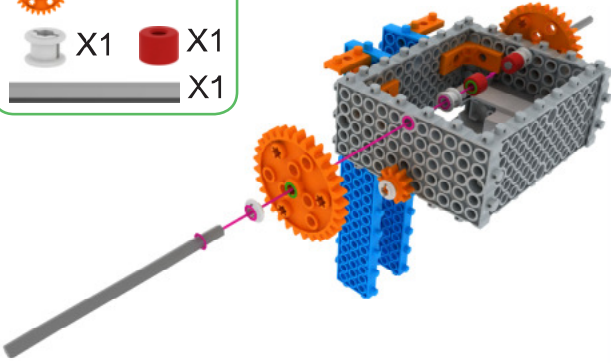
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- X1
- X1
- X1
- X1
- X1



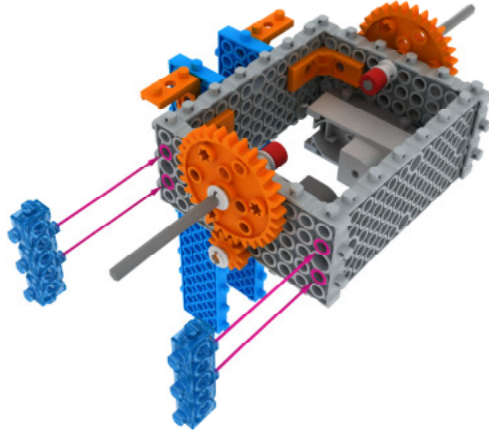
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-  X1
-  X1
-  X1
-  X1
-  X1

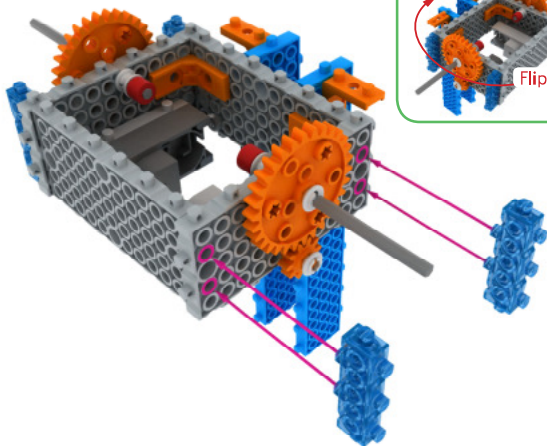


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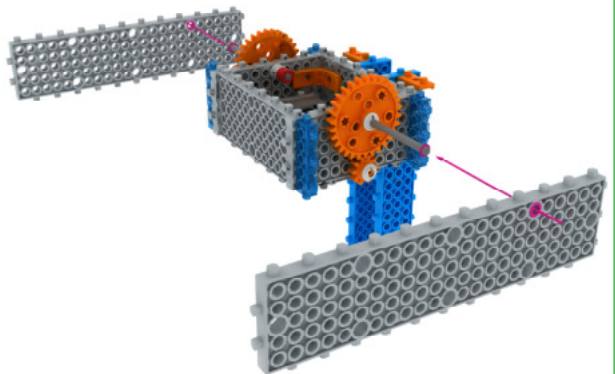
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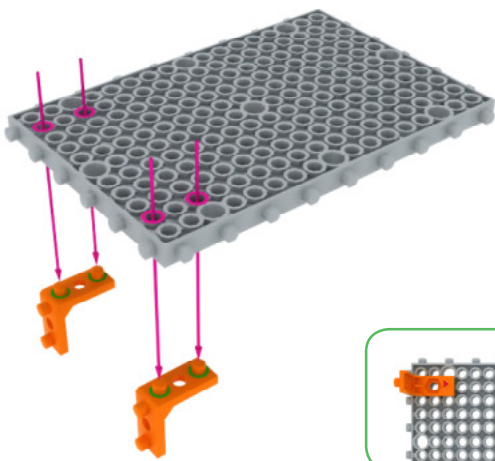
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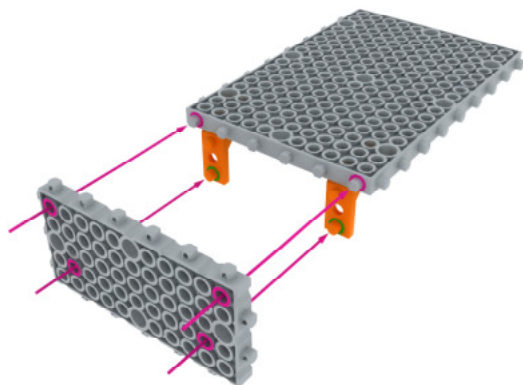
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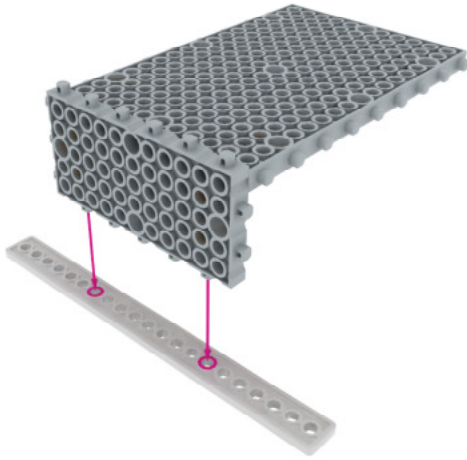
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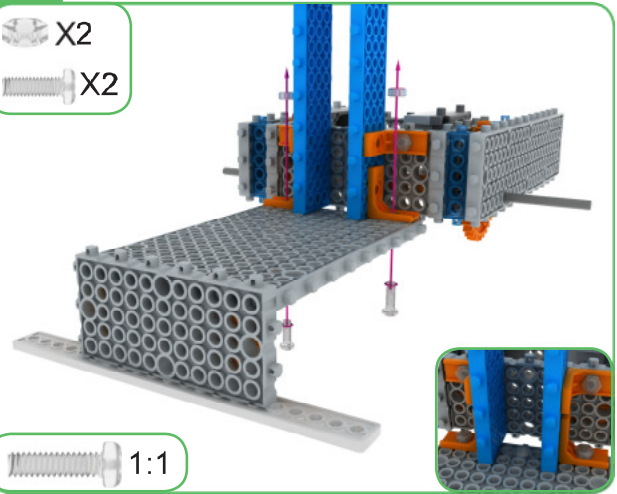


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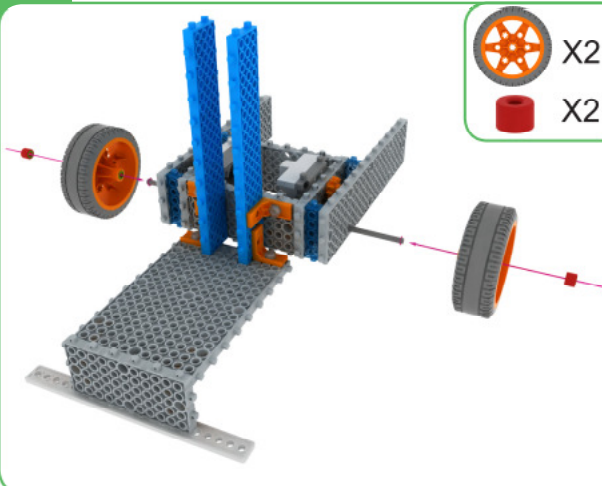
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-  X2
-  X2

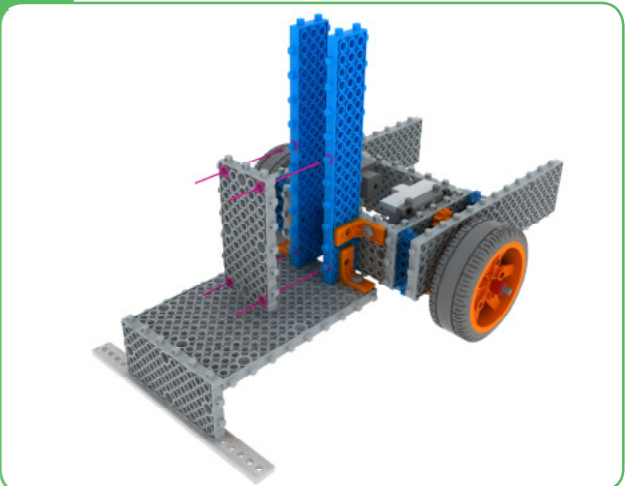


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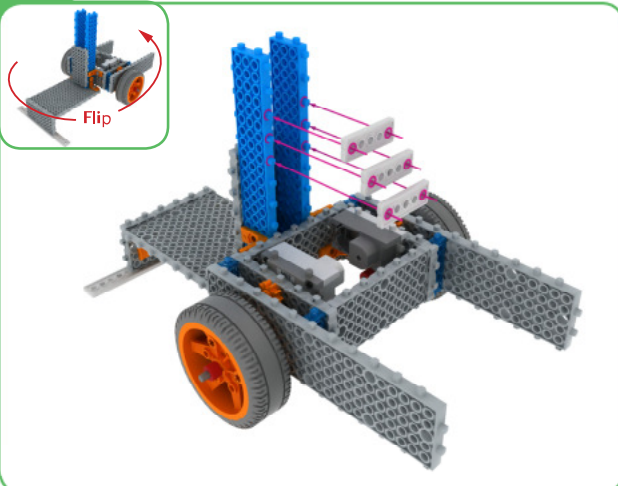
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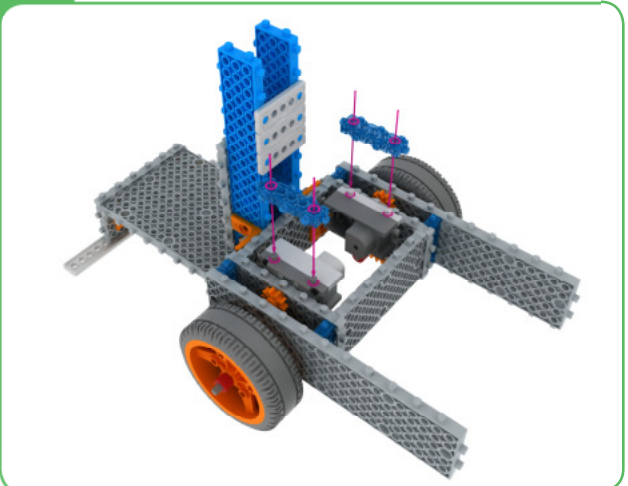
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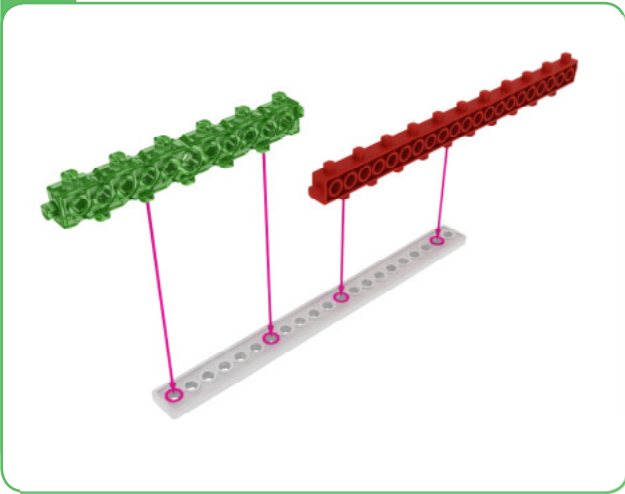
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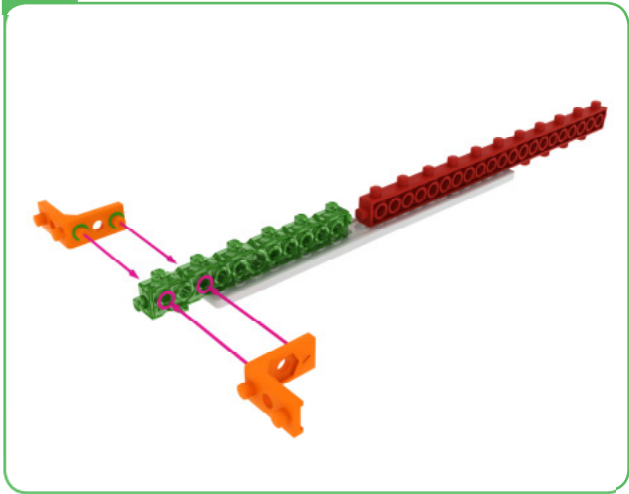
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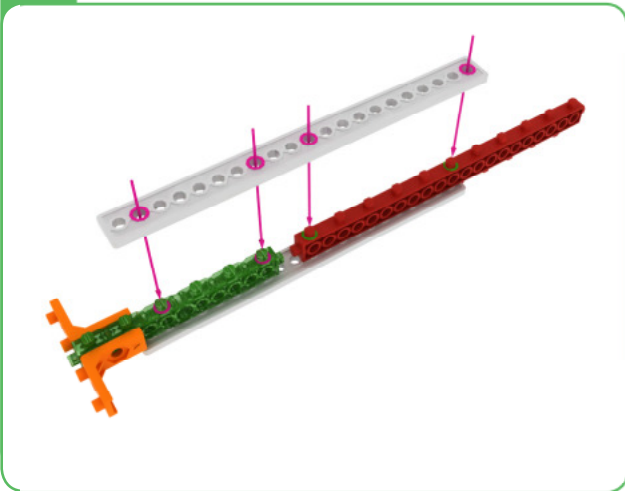
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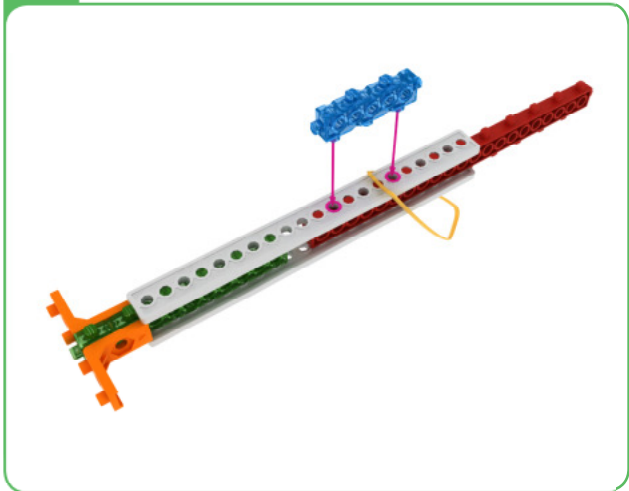
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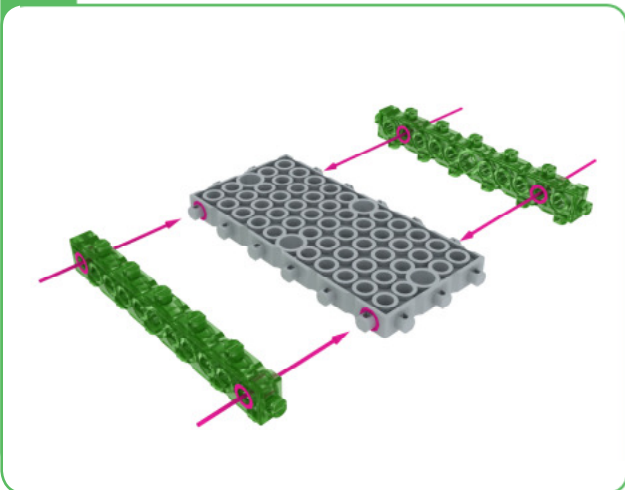
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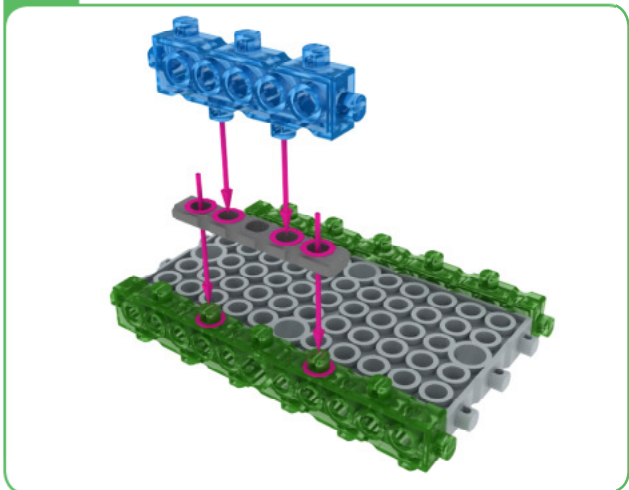
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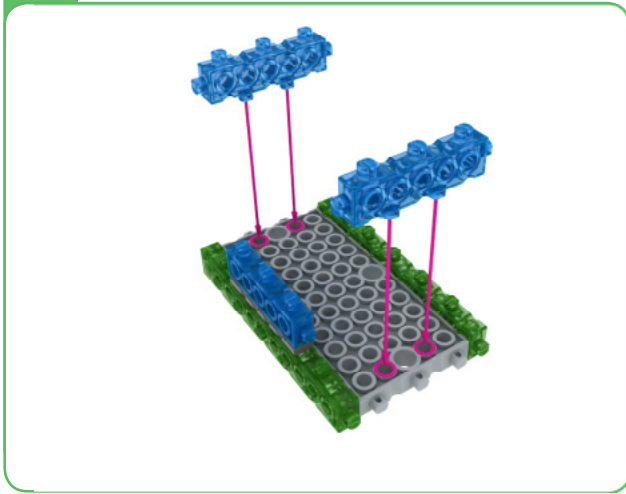
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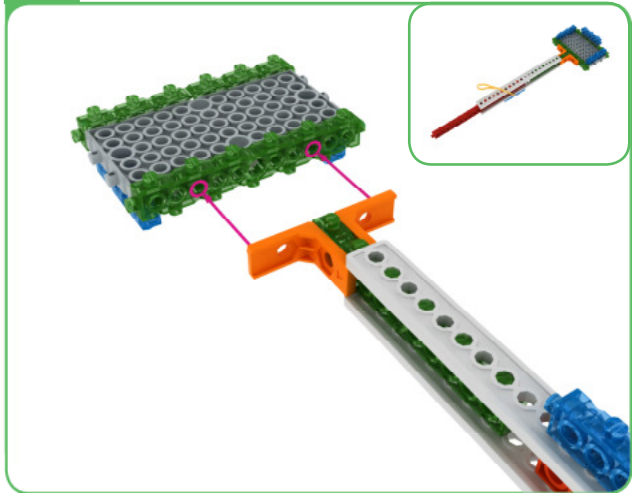
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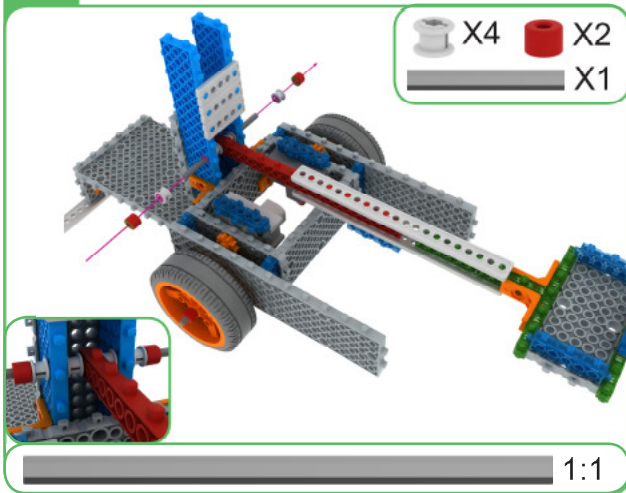
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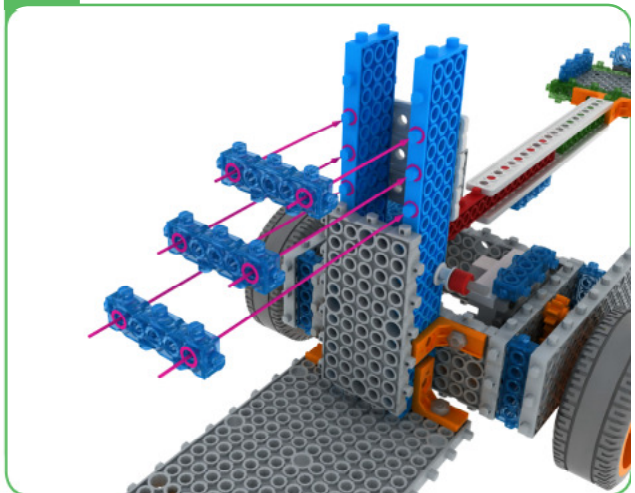
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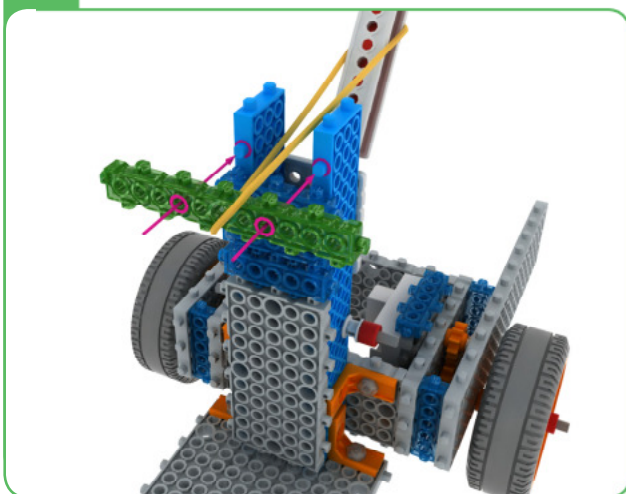
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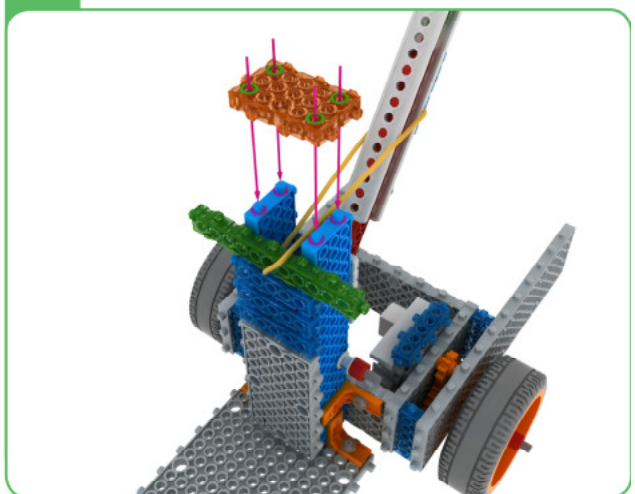
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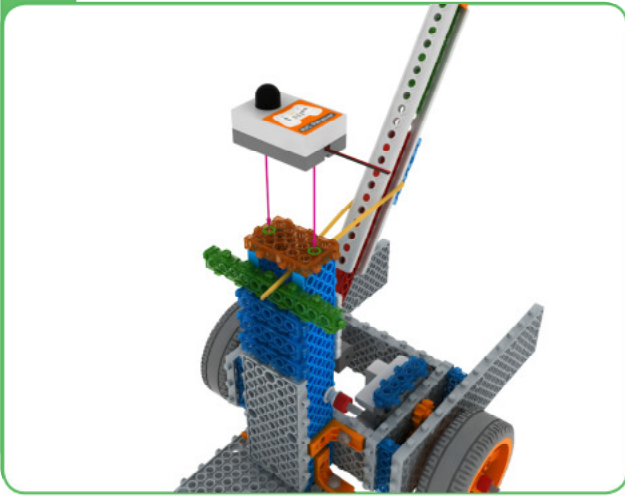
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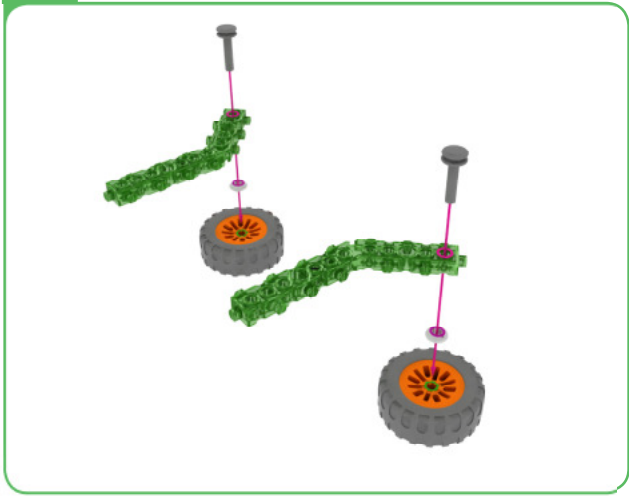
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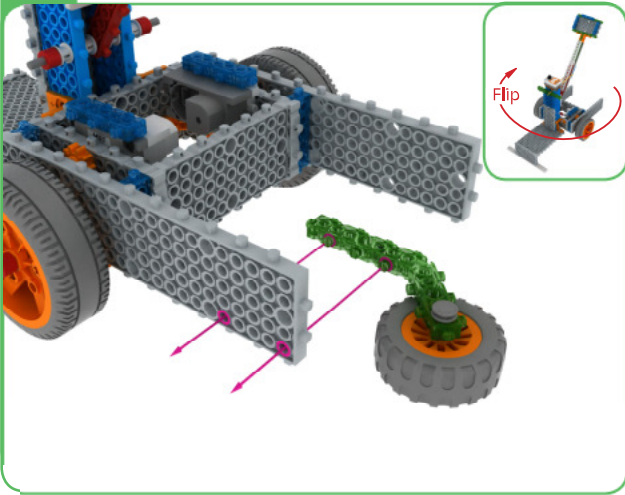
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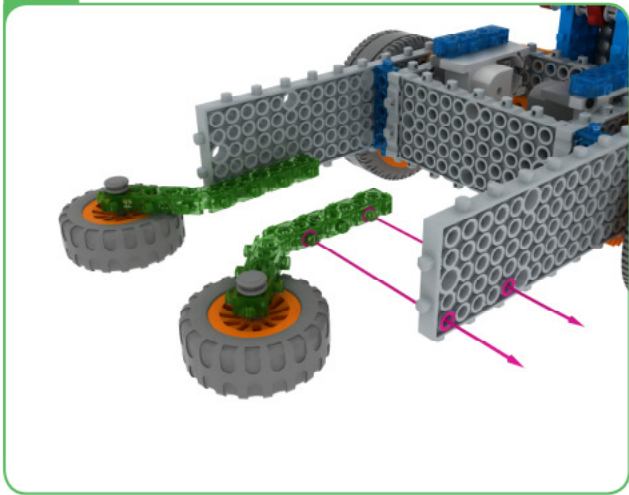
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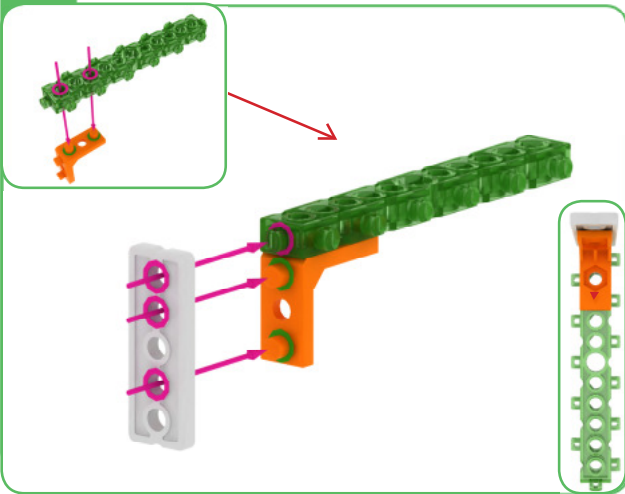
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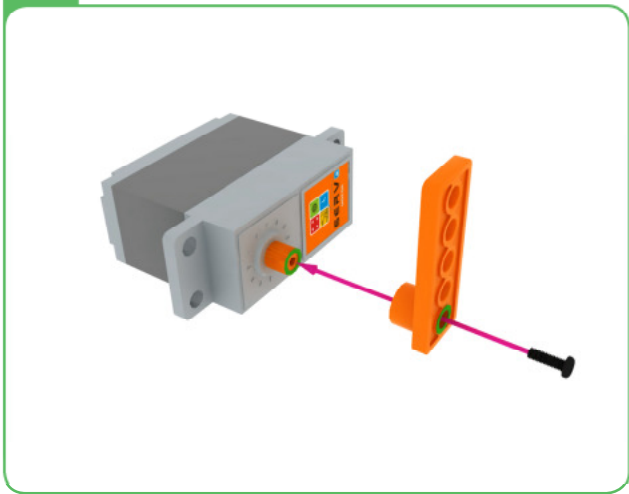
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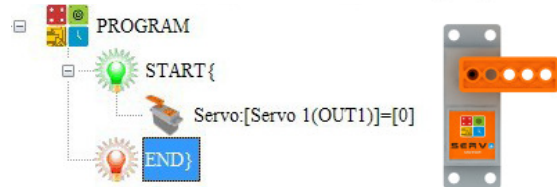


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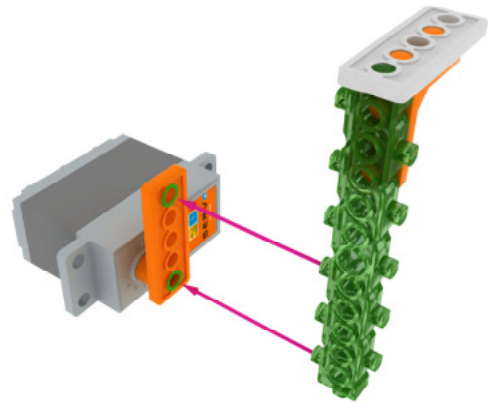
Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

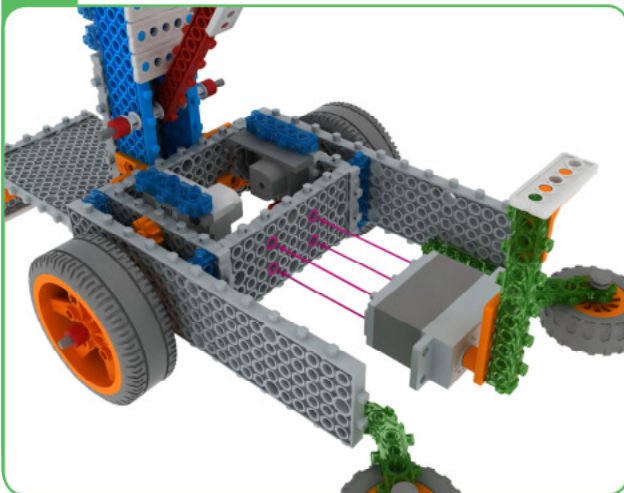


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

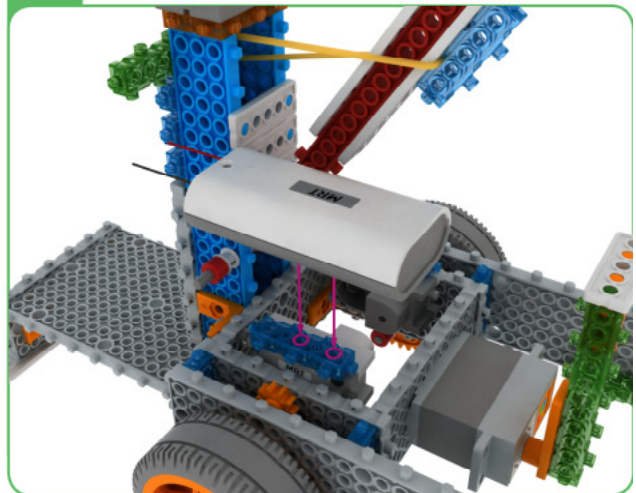
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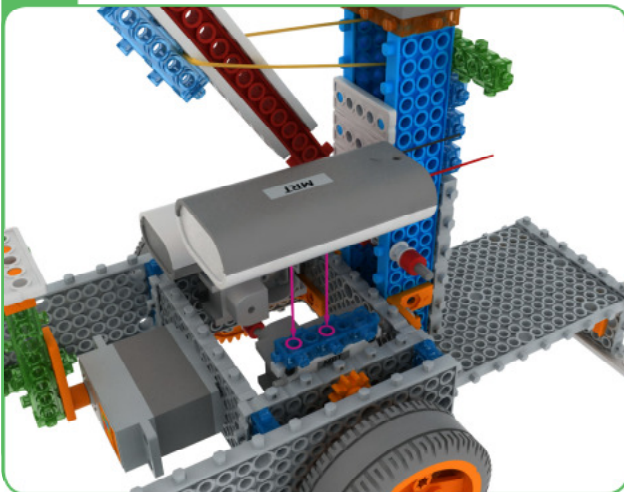
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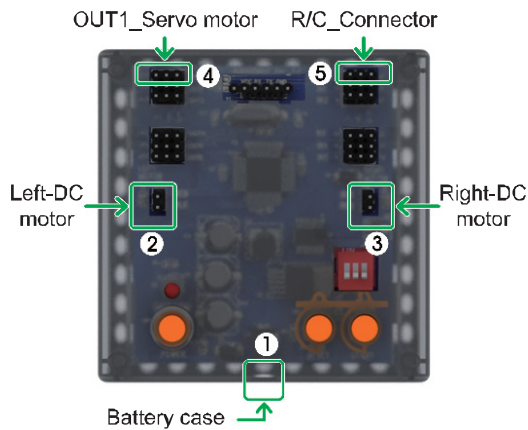
End





How to operate the Catapult

Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.

Motion Pattern/Program

1



2



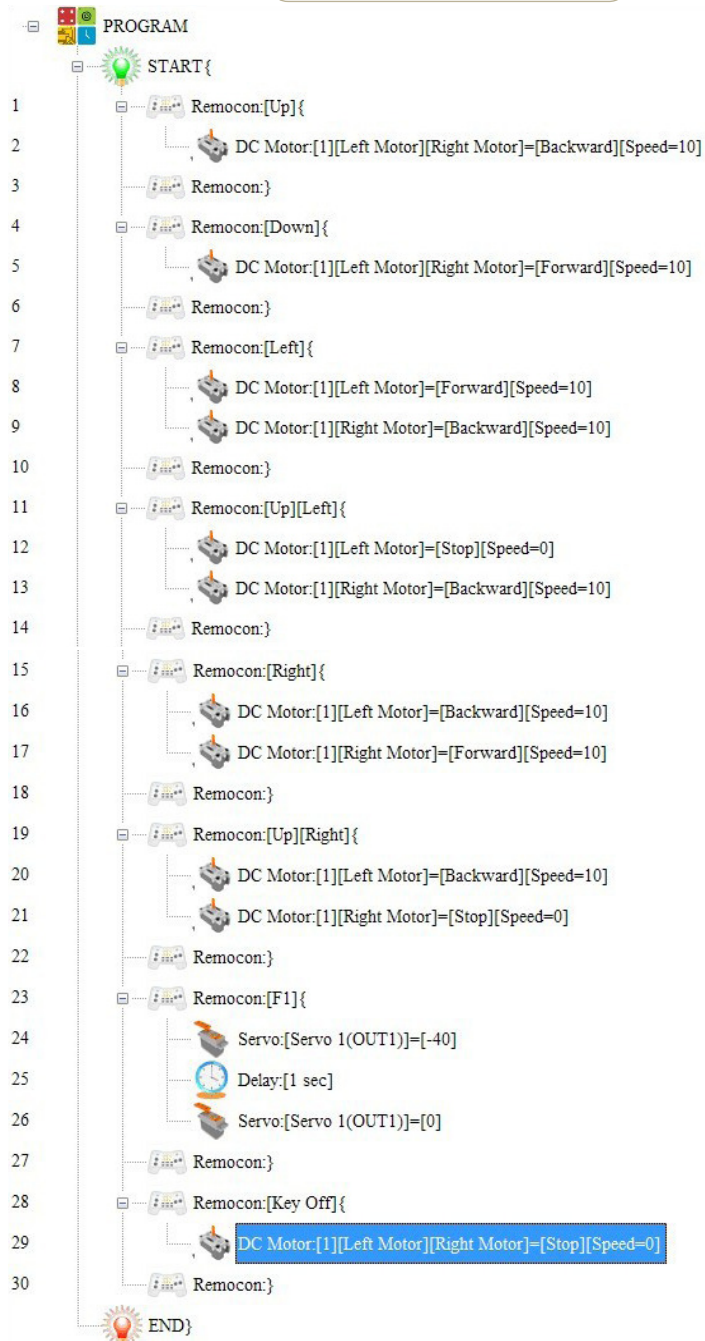
- ① Hang the catapult arm installation to the safety link that is connected to the servo motor.
- ② When the remote control's **F1** Key is pressed, the catapult will launch itself .

※ - Using the motion patterns as reference, let's write the program.

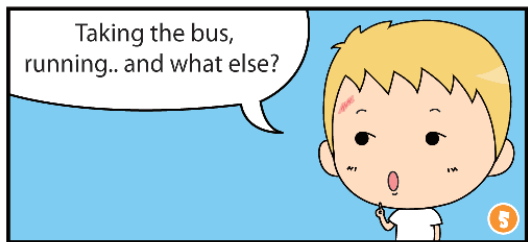
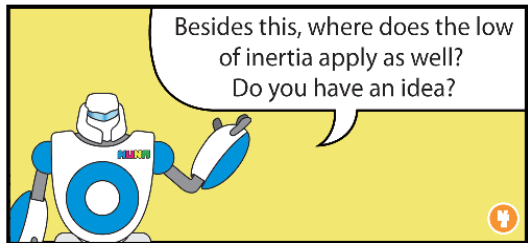
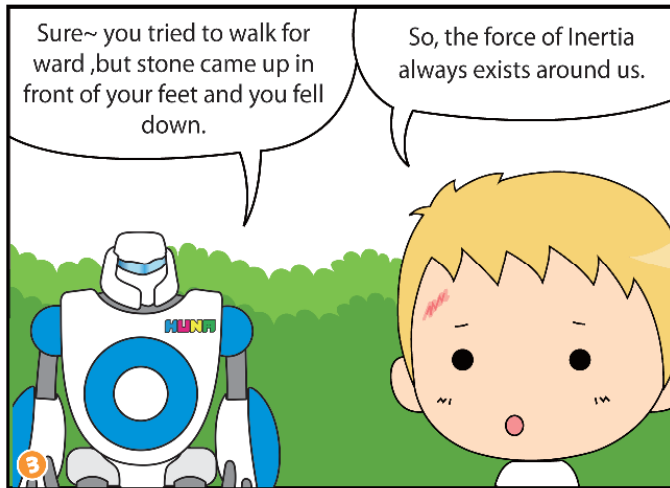
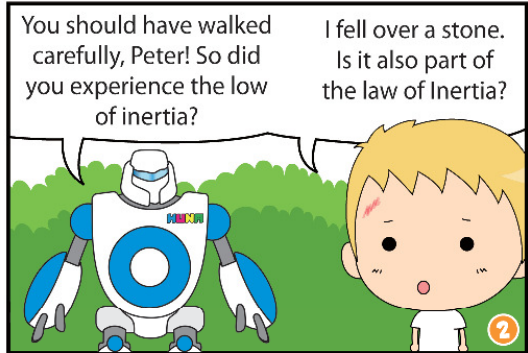
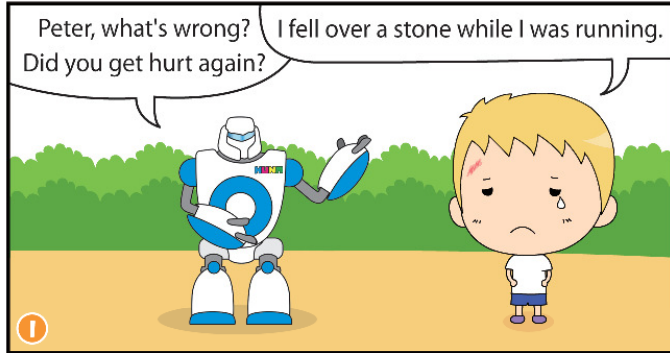
Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

Program Example



S Science **STEM 12. The law inertia can be seen all around us!**

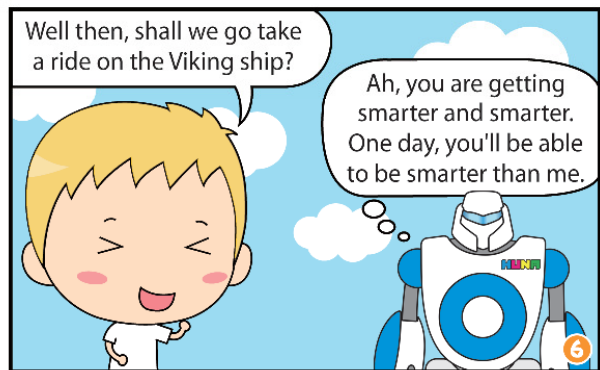
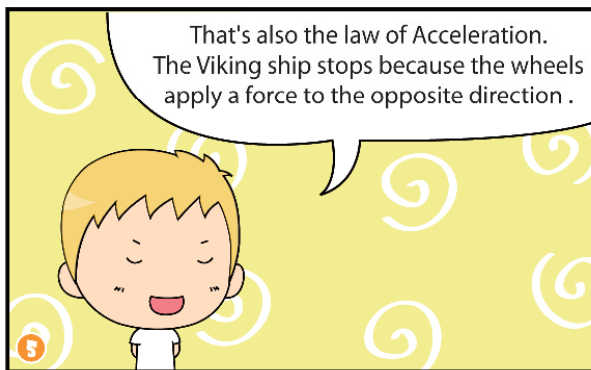
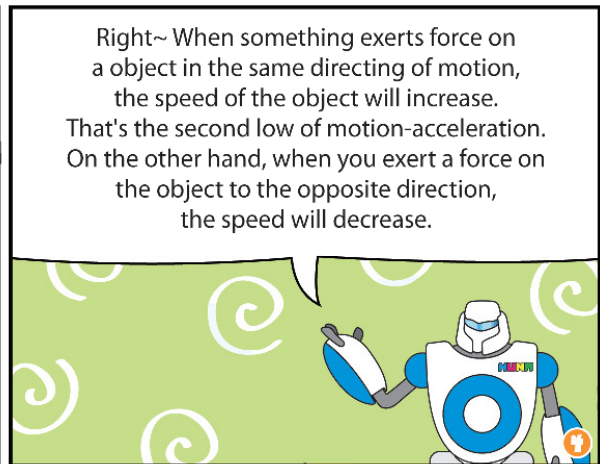
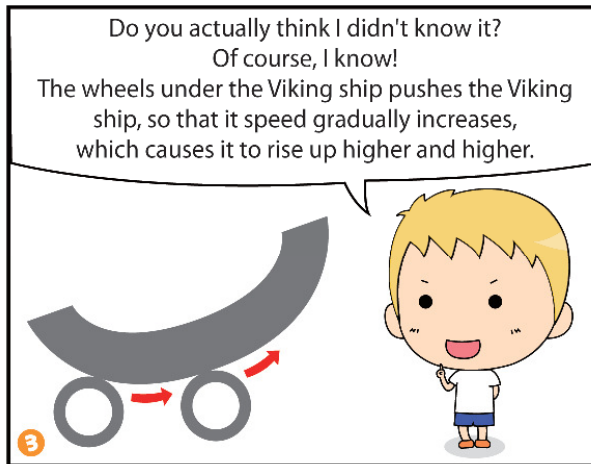
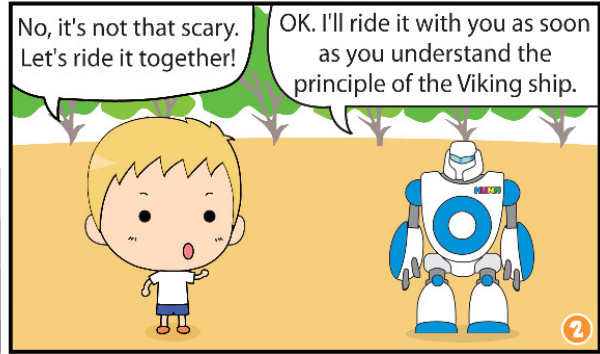


Think and write down all of things around you that is effected by the low of inertia!

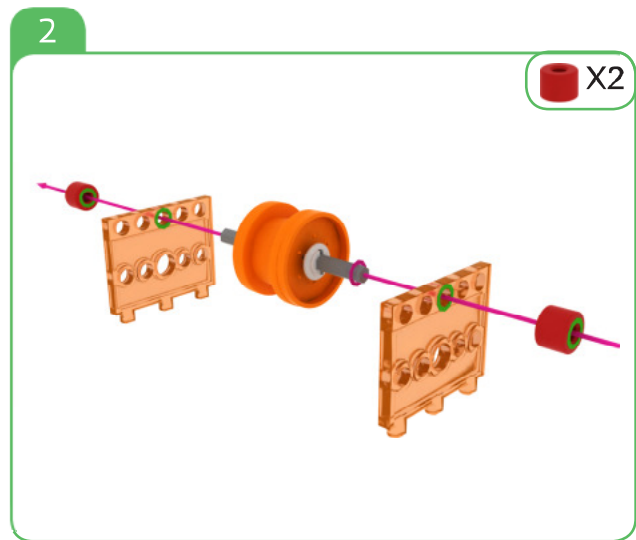
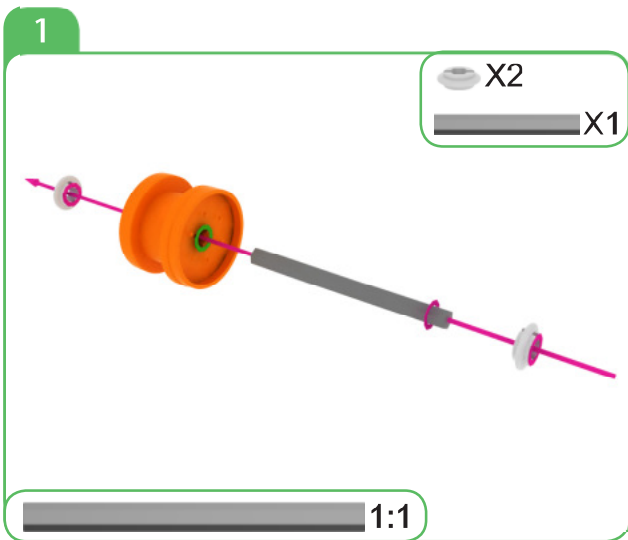
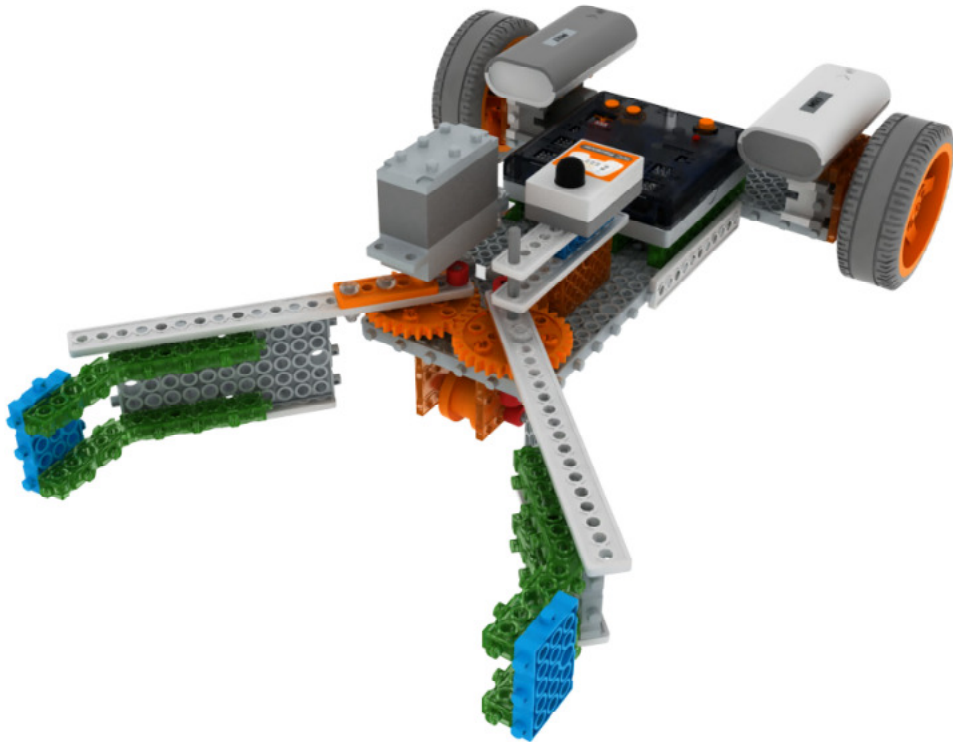
Spiral notebook with lined writing area.



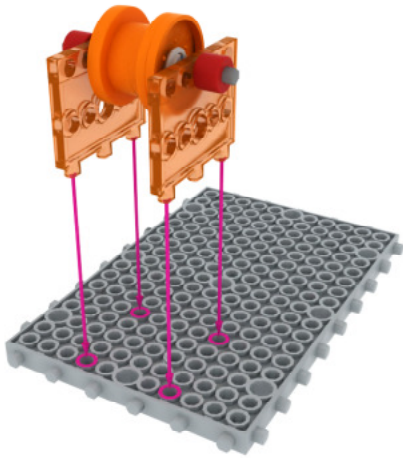
STEM 13. The second law of motion-Acceleration



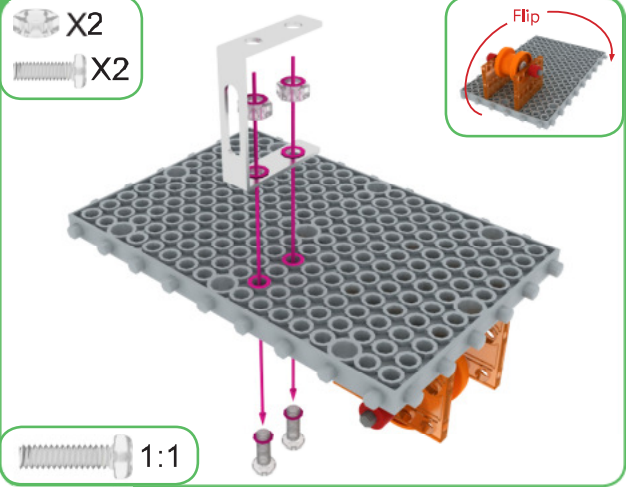
T Technology
E Engineering
Robot Making7-Forceps Robot



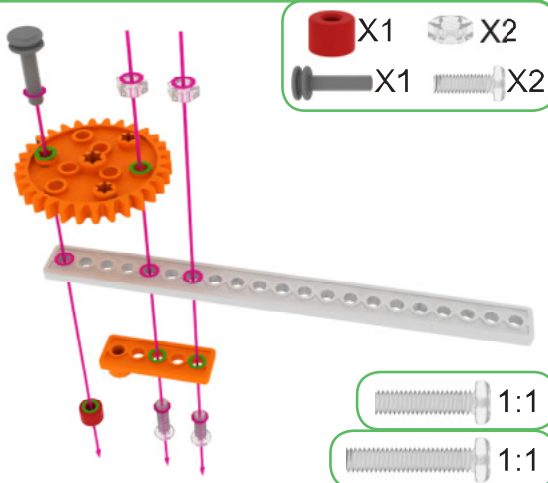
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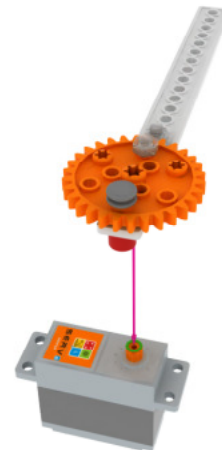
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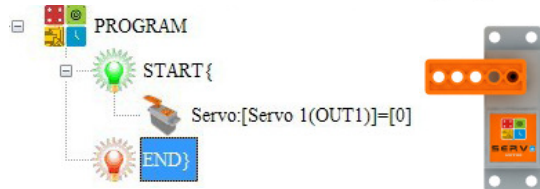


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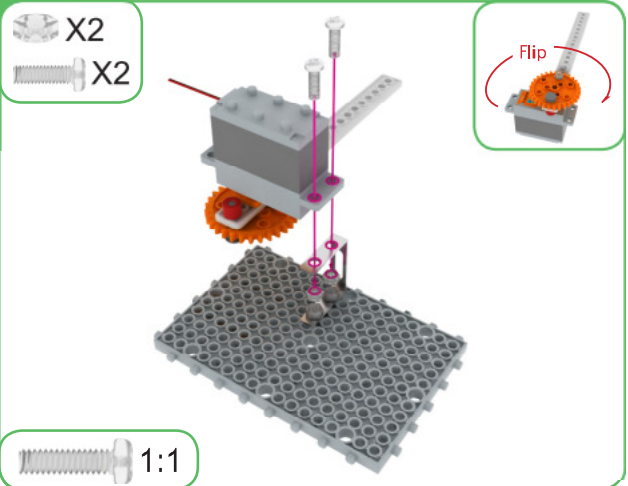
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7



8

X1

9

1:1

10

X1 X2 X2
X1 X1

1:1

11

X1 X1
X1

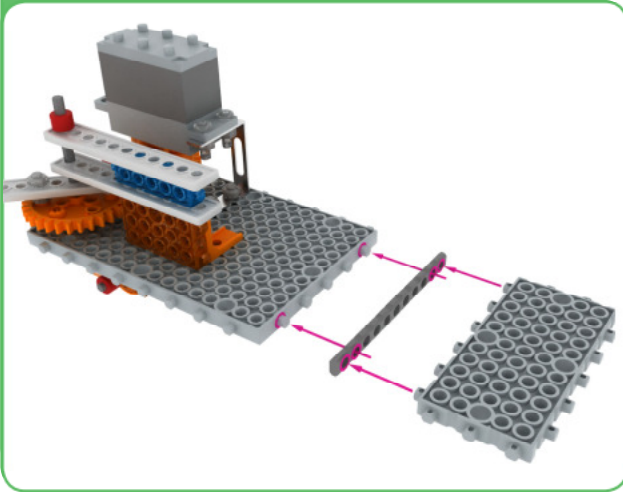
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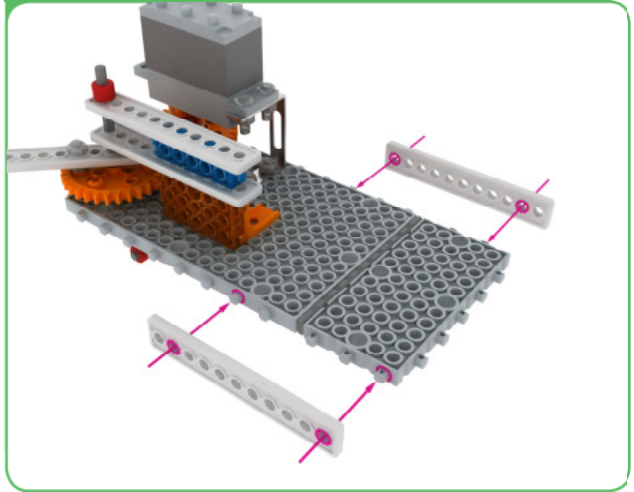
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X1

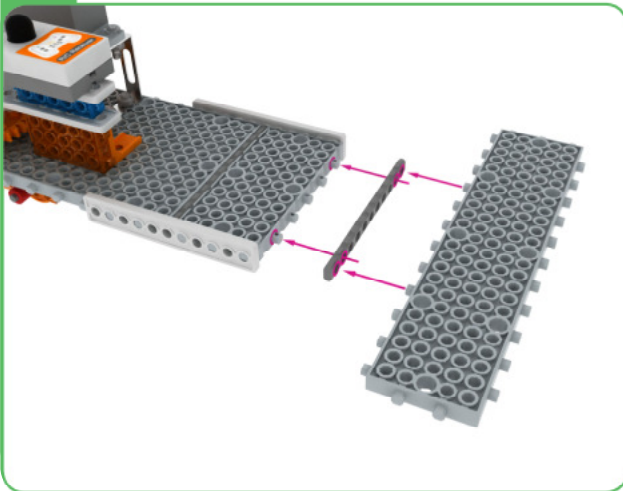
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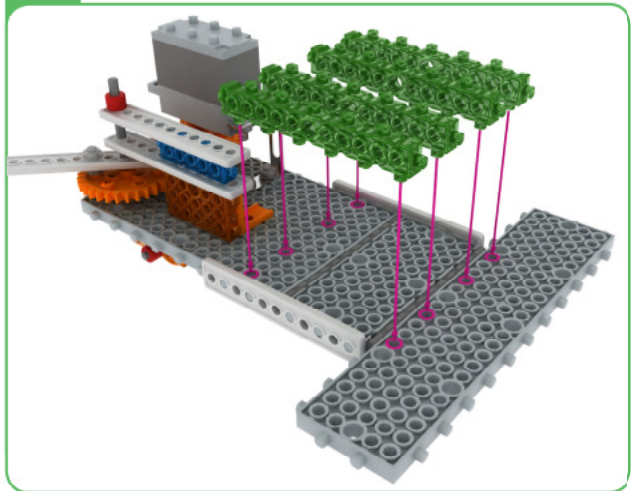
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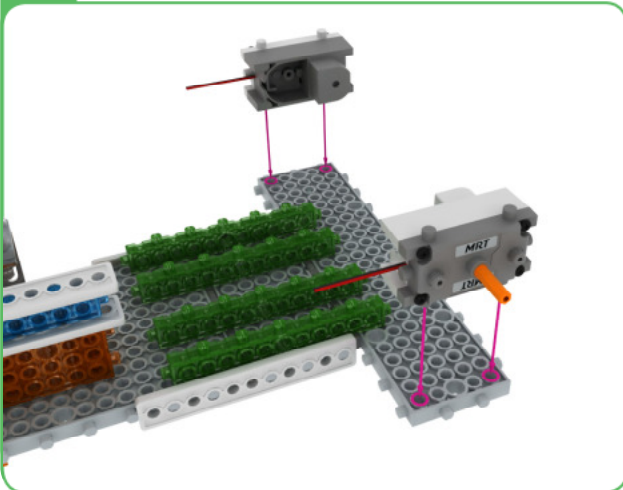
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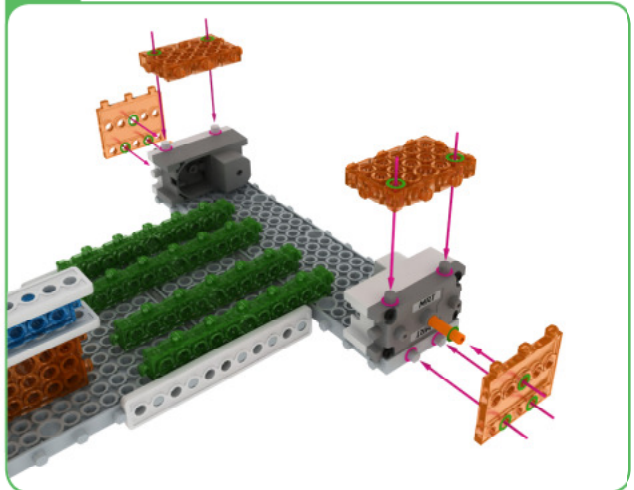
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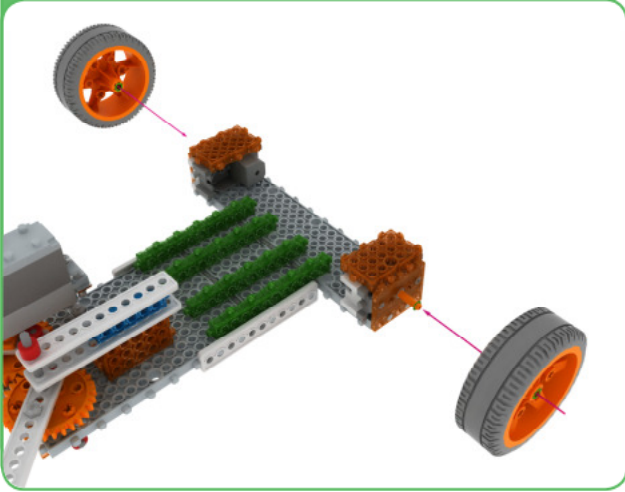
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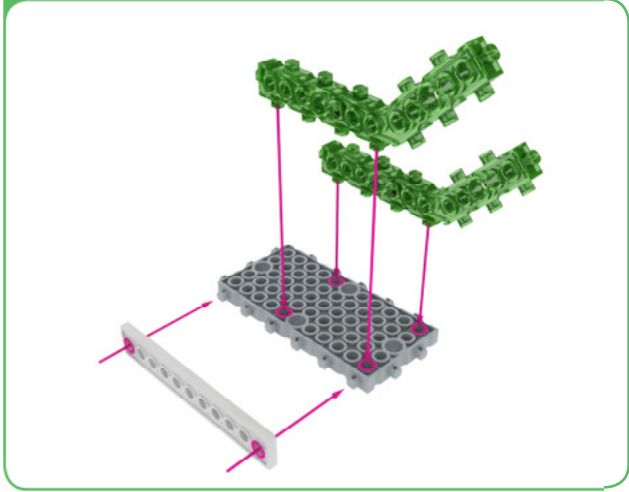
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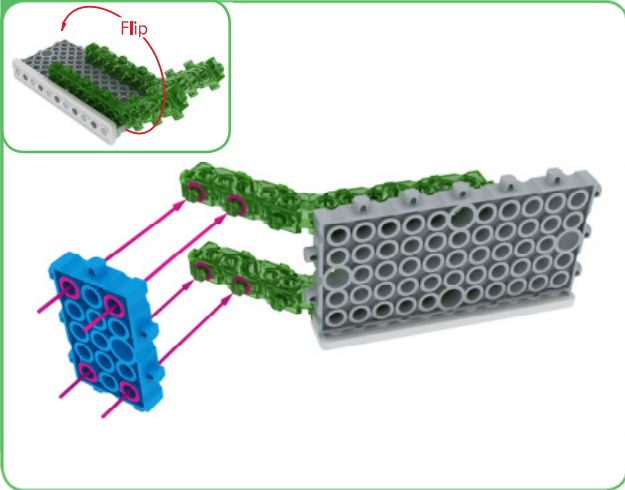
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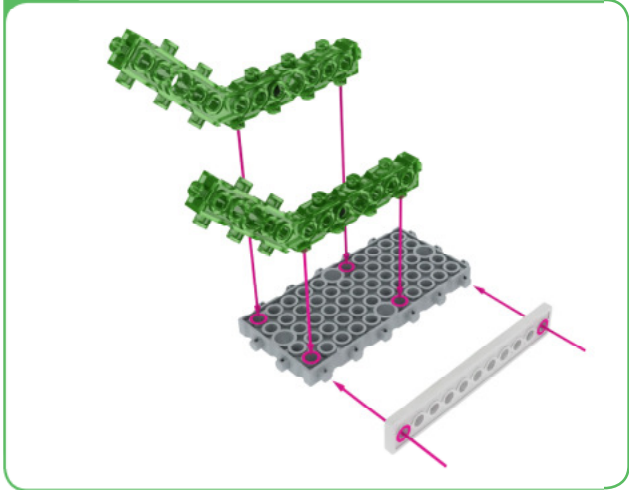
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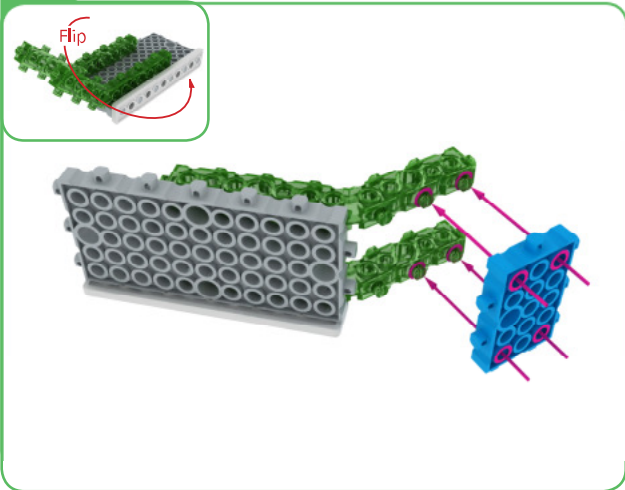
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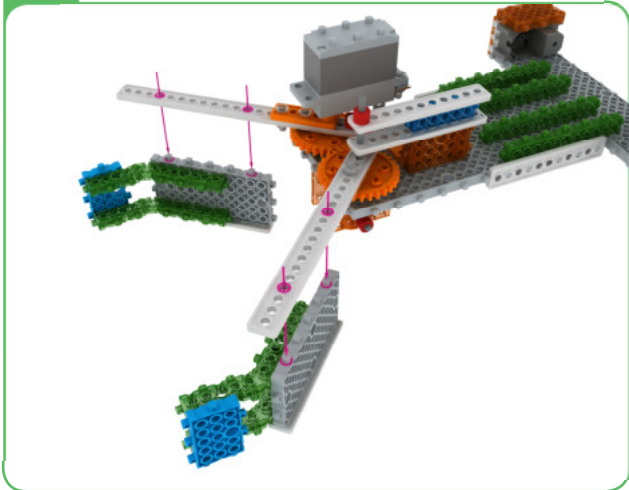
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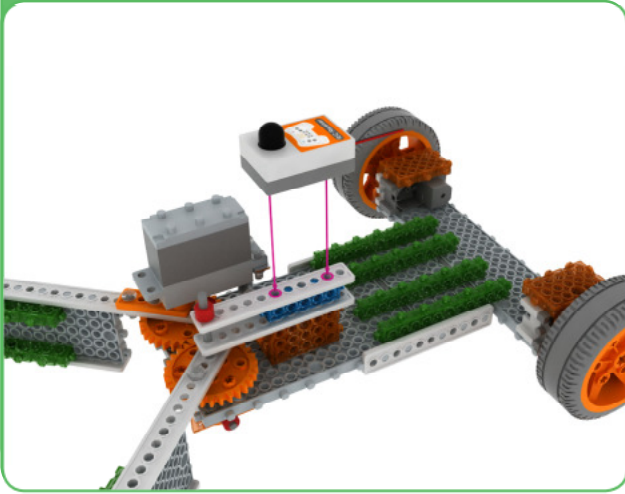
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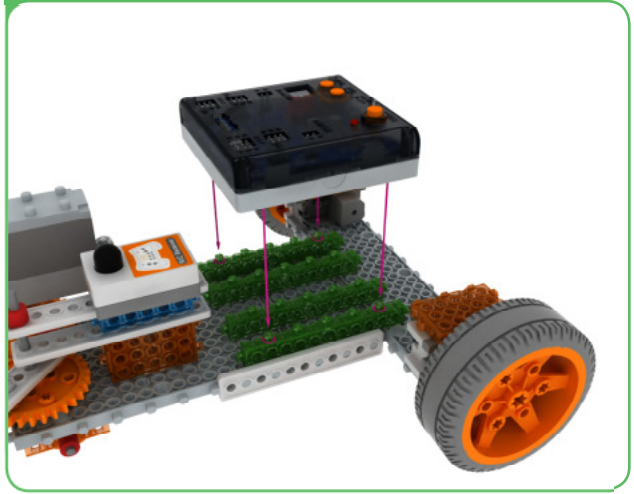
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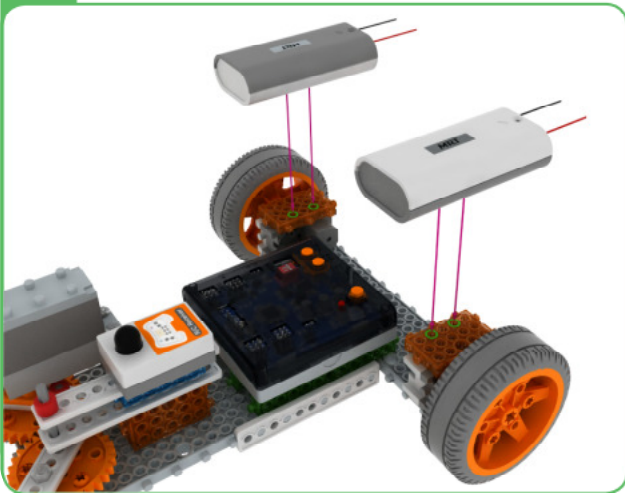
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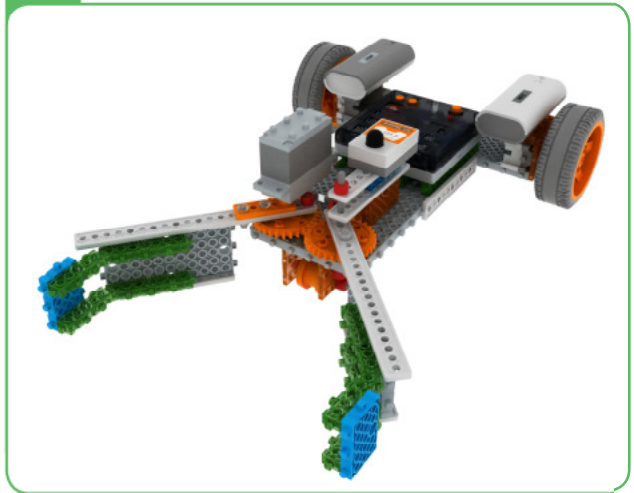
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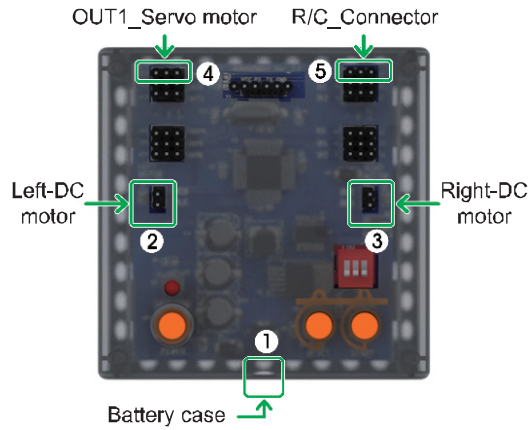
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How to operate the Forceps Robot

Connecting the main board

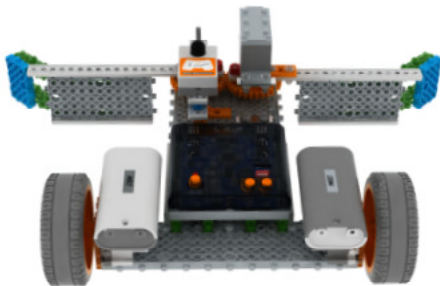


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5. Connect RC receiver board to R/C connector.

Motion Pattern/Program

1



2

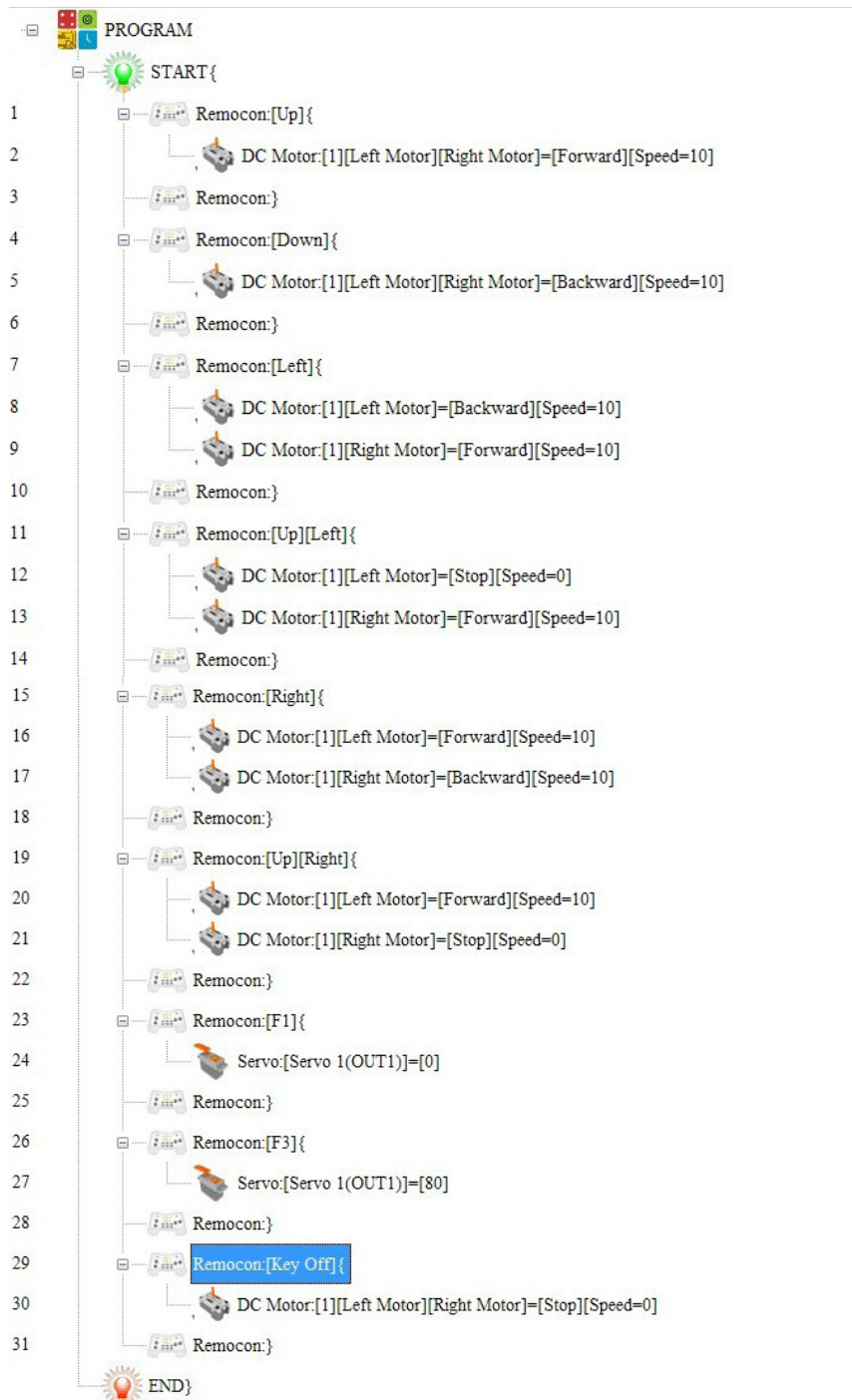


※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

Program Example





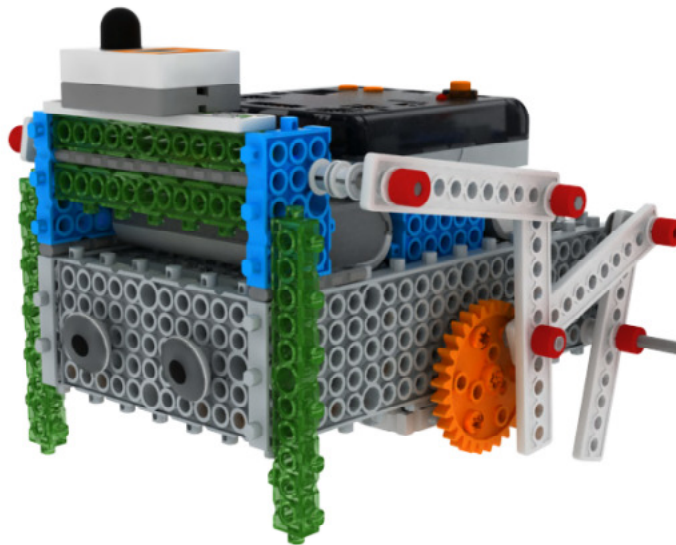
Science

**STEM 14. The third law of motion
-Action and Reaction**

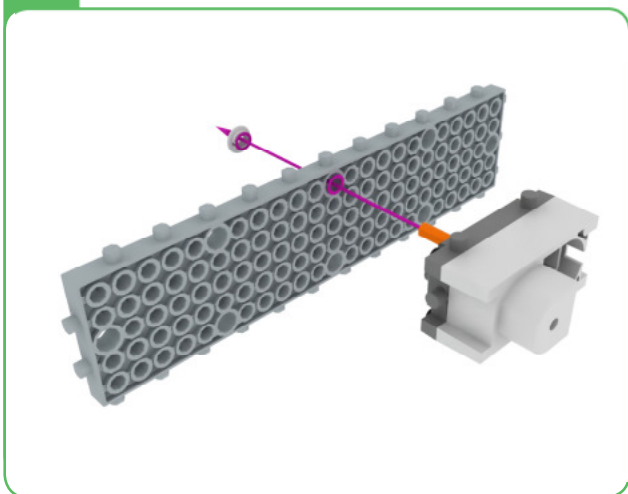
<p>1</p> <p>Yap! Go ahead, crash against the side of my car!</p>	<p>2</p> <p>Bang!</p>	
<p>3</p> <p>Bumper cars are very exciting! Huna, why did my car move backwards when I hit your car?</p>	<p>Because of the third law of motion - Action and Reaction.</p>	<p>4</p> <p>Action and Reaction? Is there another law of motion besides Inertia and acceleration?</p>
<p>5</p> <p>Yes, Action and Reaction is the last law of motion. The law is... As you exert a force upon an object, that object will exert the exact same force upon you. As your bumper car pushed my bumper car, just now, my bumper car pushed your bumper car with exactly the same force.</p>	<p>6</p> <p>Wow! Now, I understand the principle of the rides.. Riding them will be even more fun now! Huna, let's go to ride the bumper car again~</p> <p>Harry, this is already the fifth time. Let's go home now!</p>	



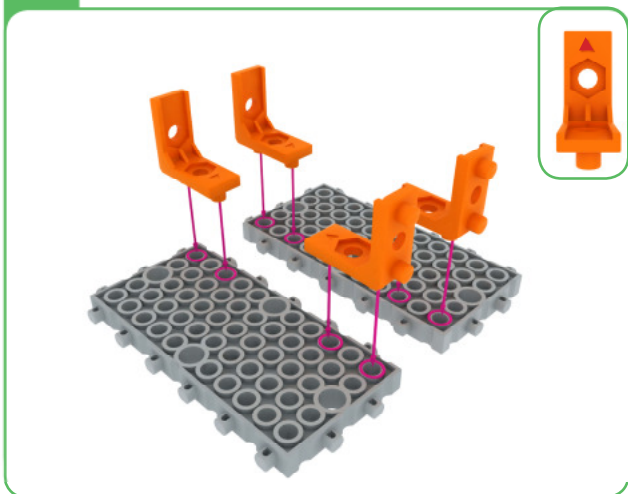
Robot Making 8-Bug Battle Bot



1

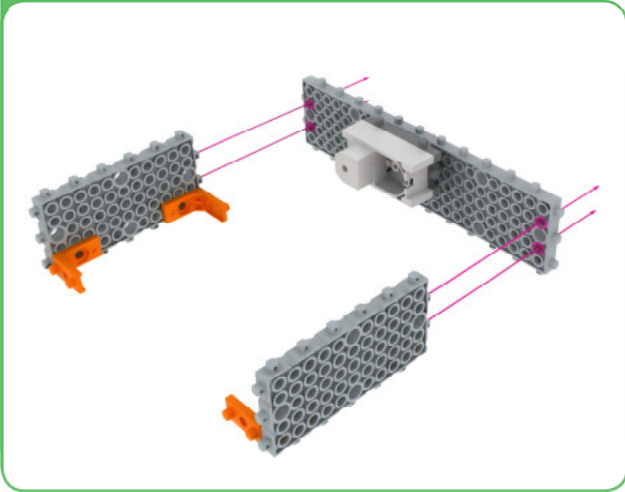


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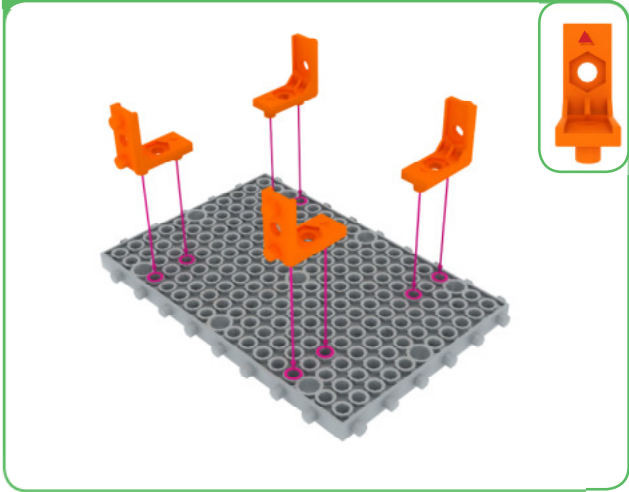


Intermediate Level

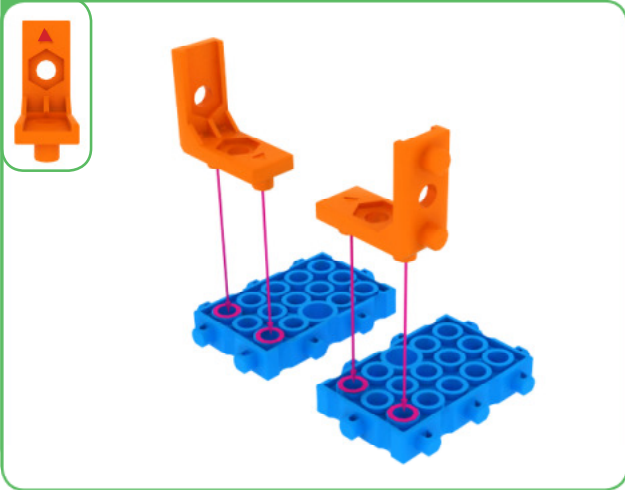
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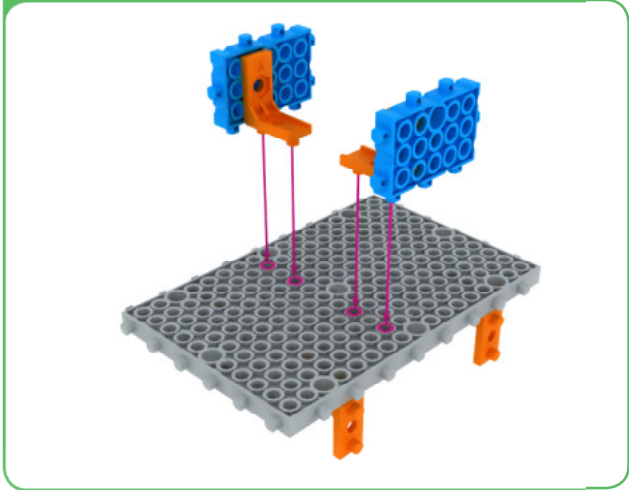
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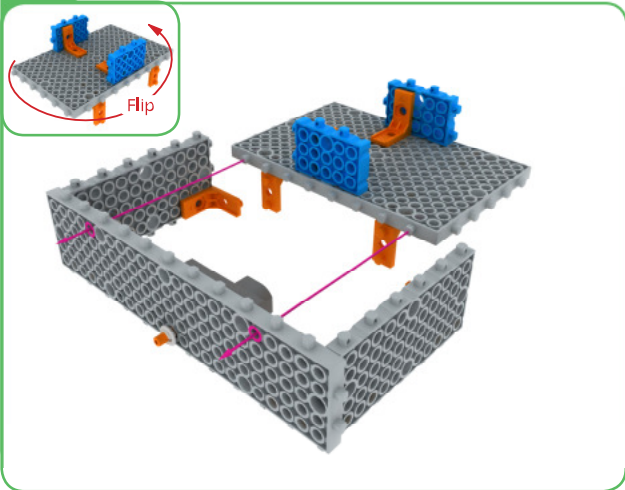
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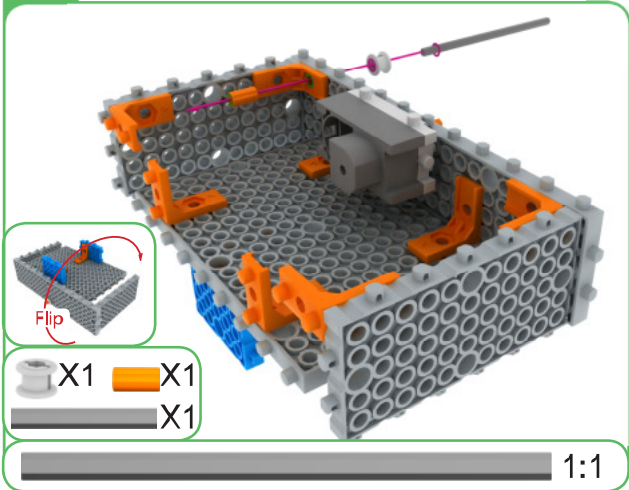
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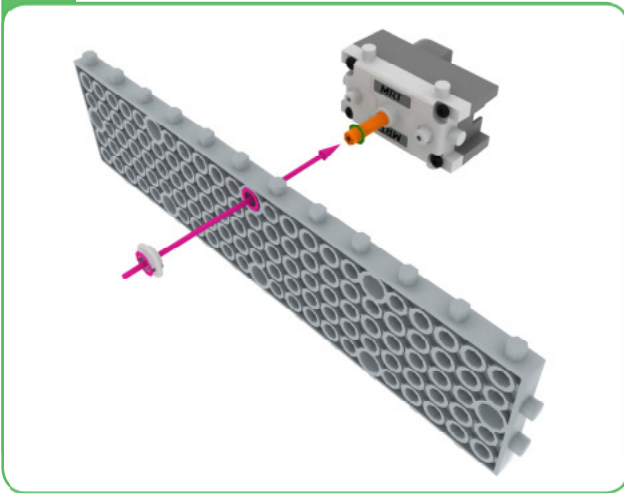
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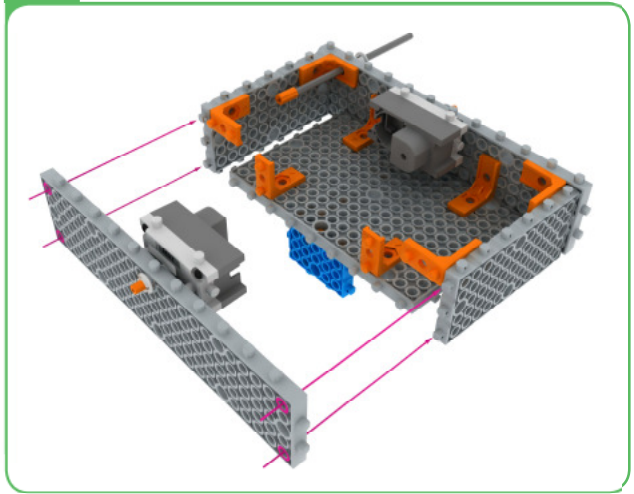
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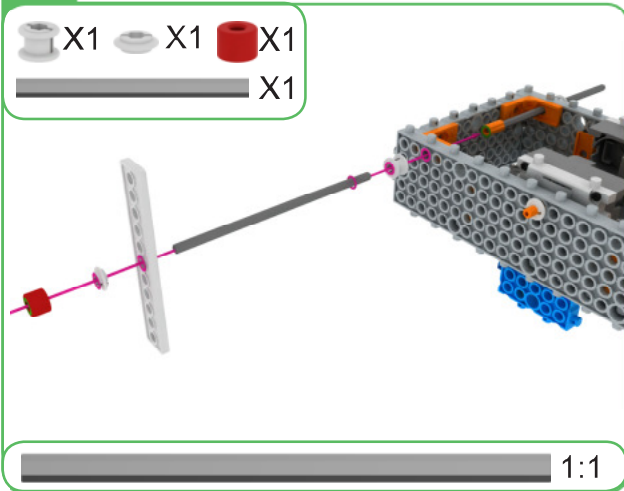
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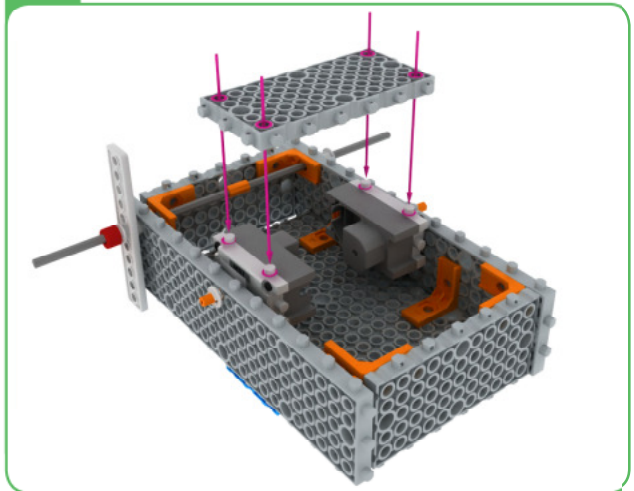
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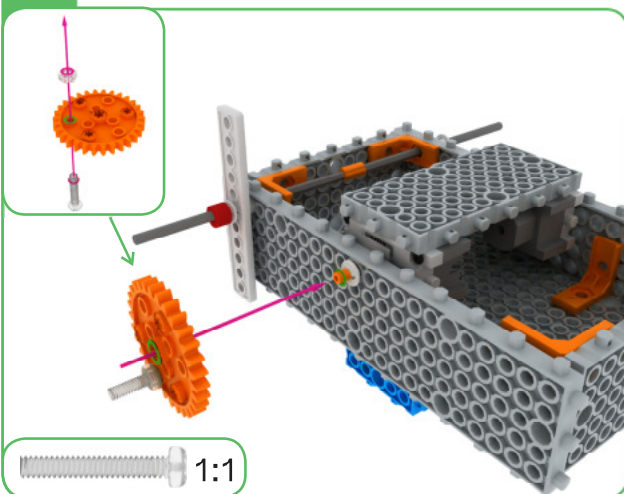
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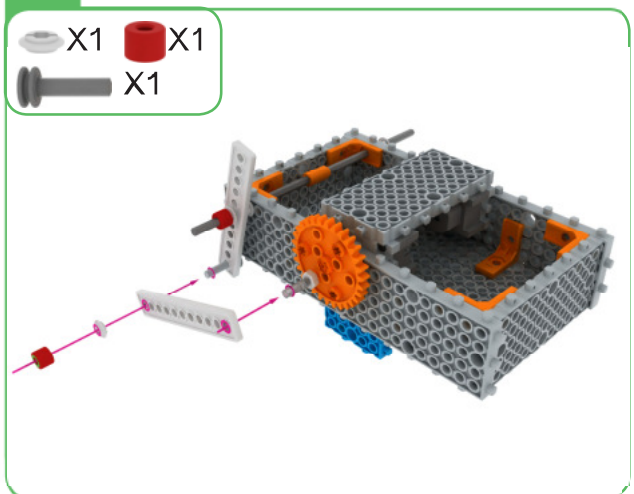
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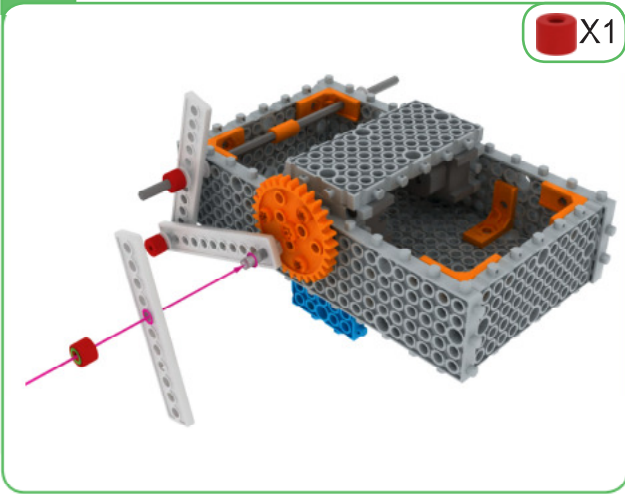
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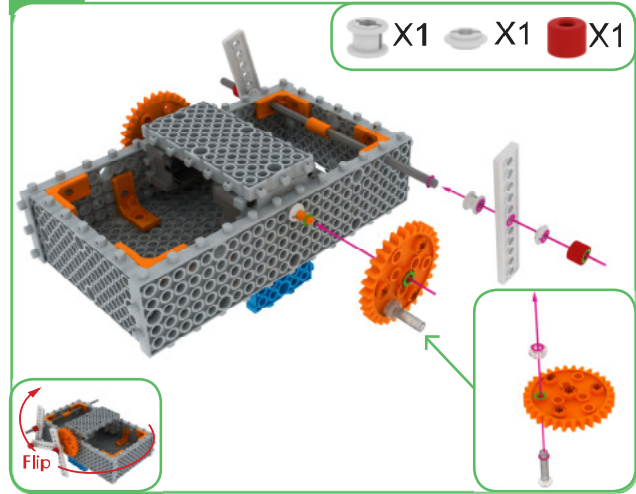
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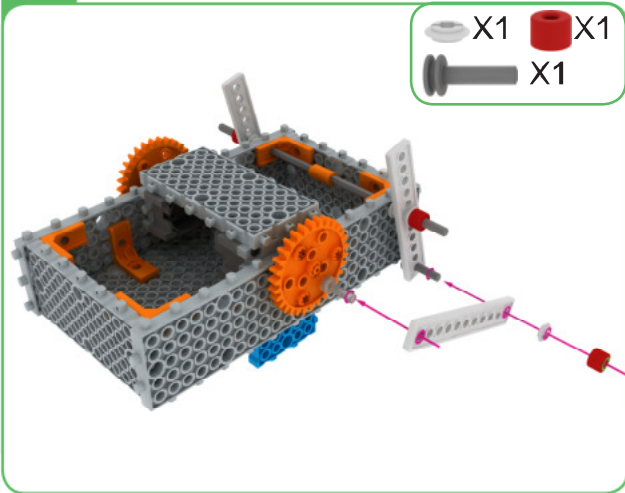
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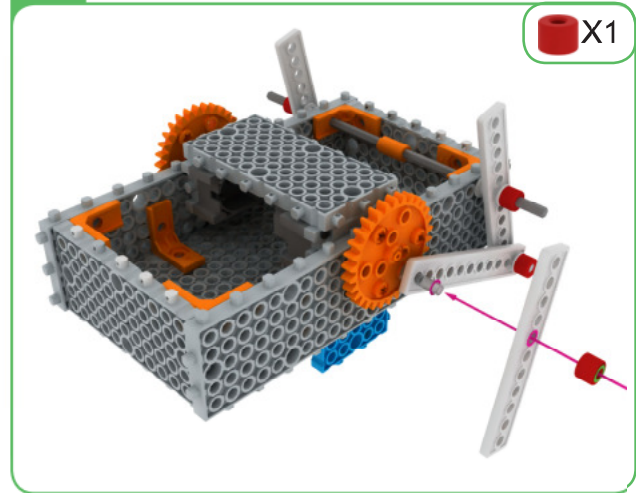
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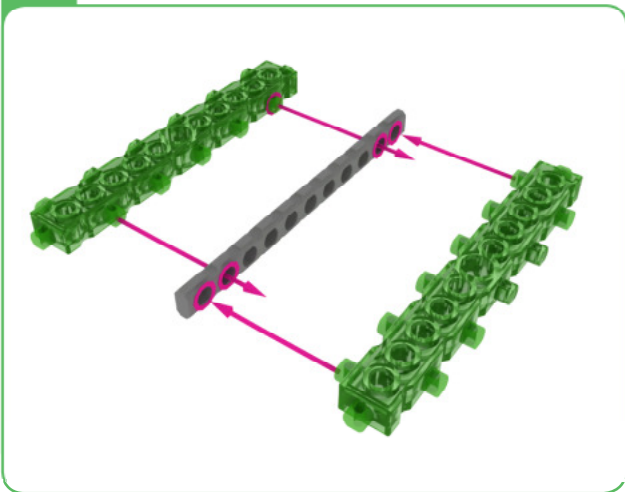
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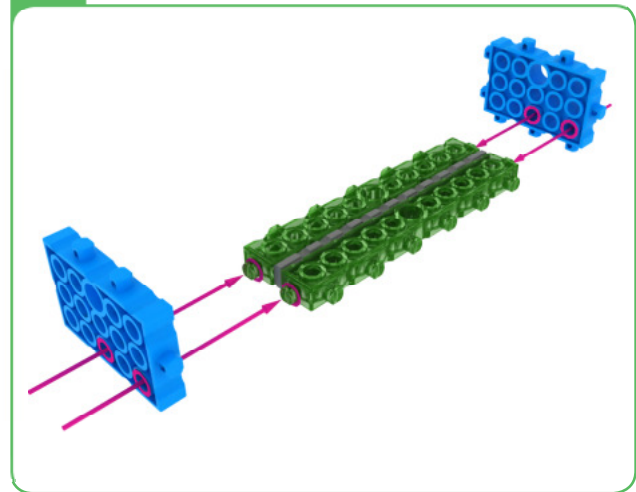
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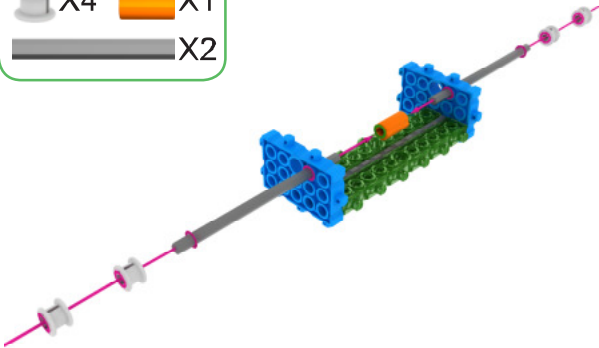


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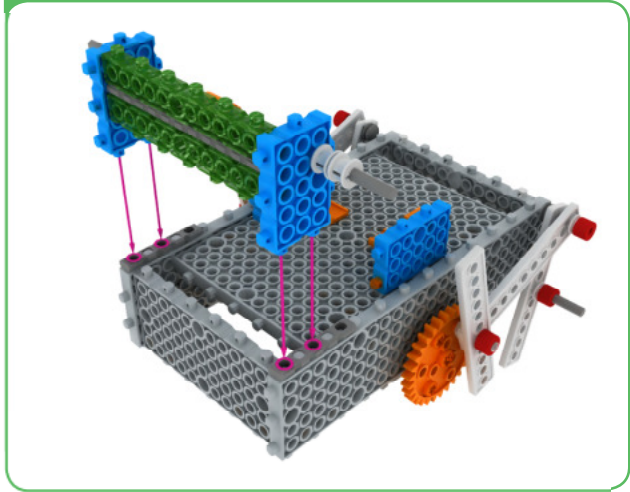


21

-  X4
-  X1
-  X2

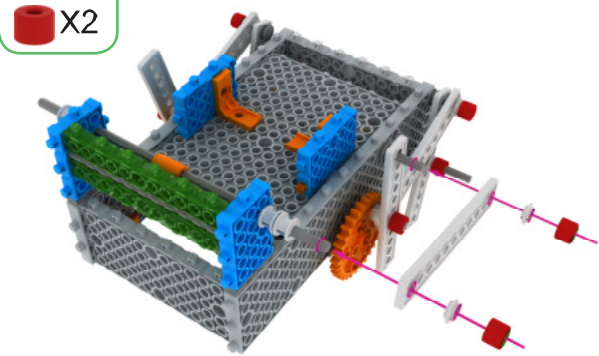


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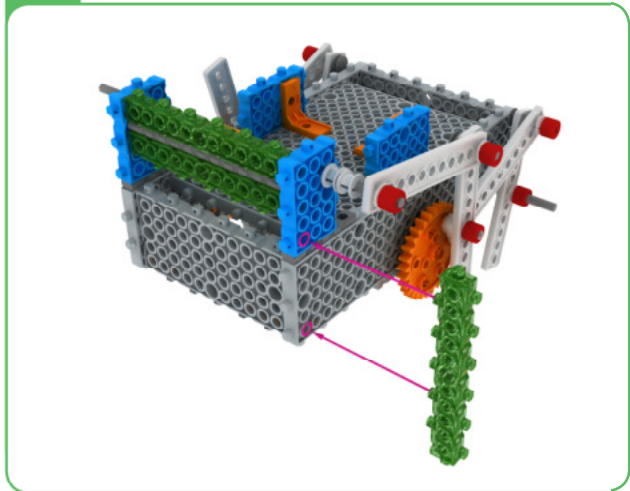


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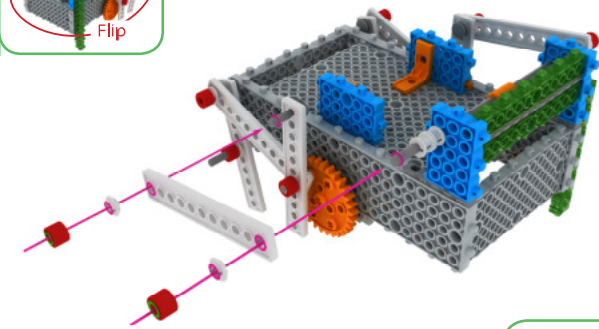
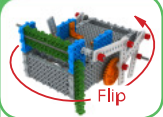
-  X2
-  X2



24

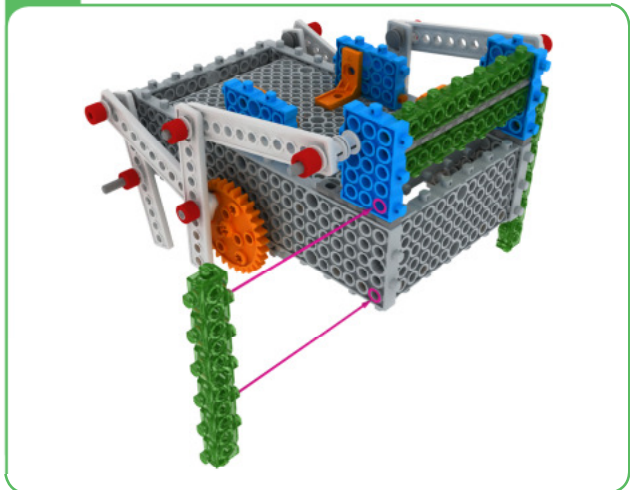


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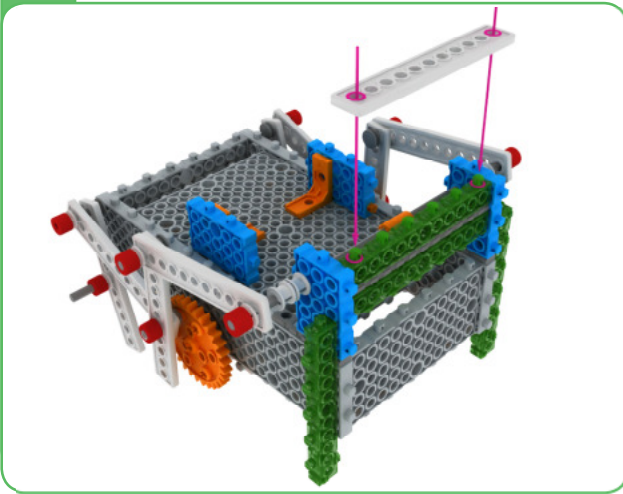


-  X2
-  X2

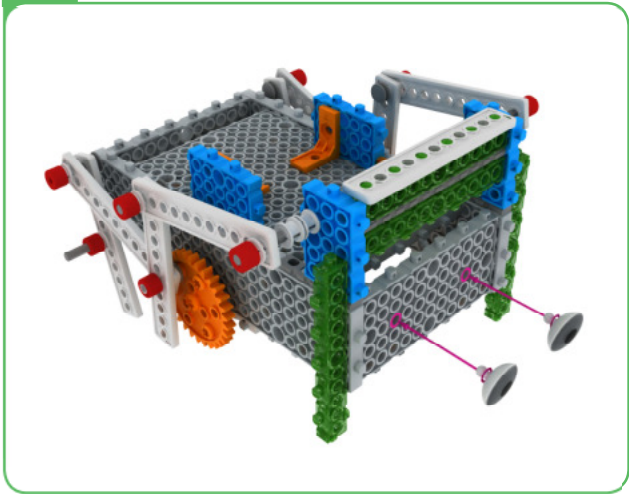
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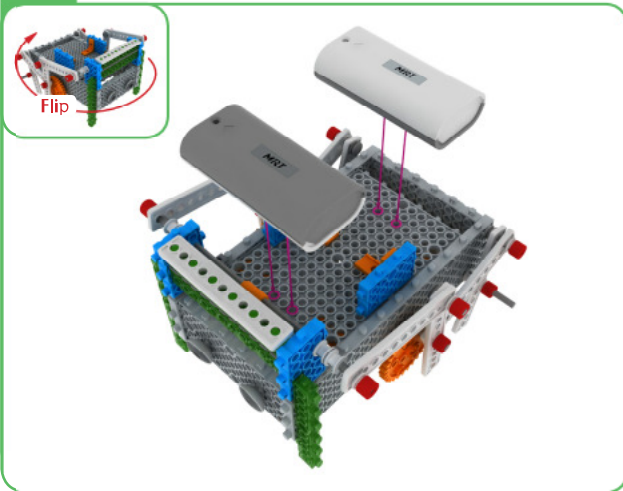
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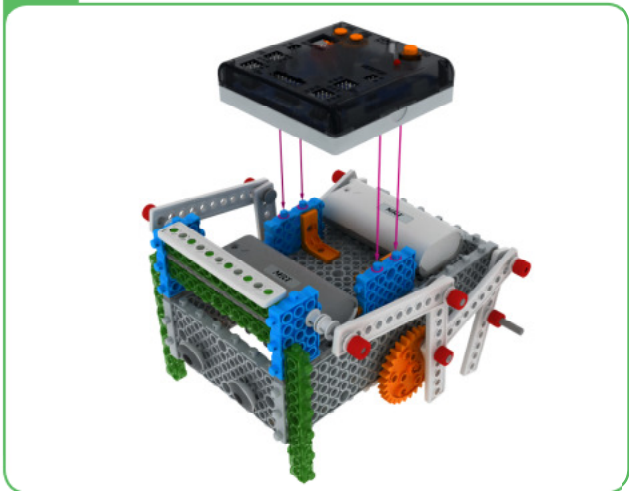
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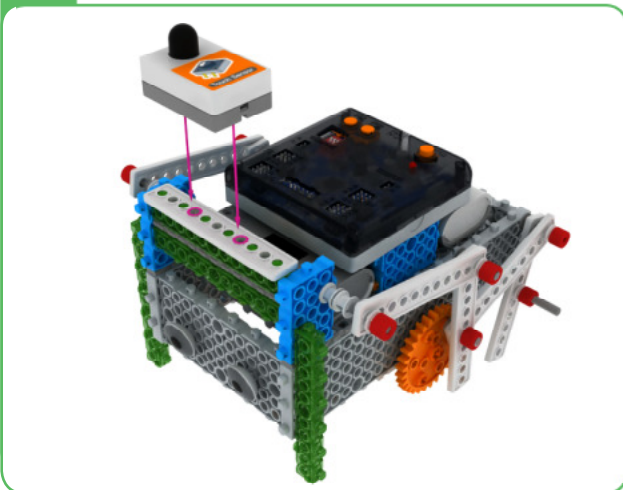
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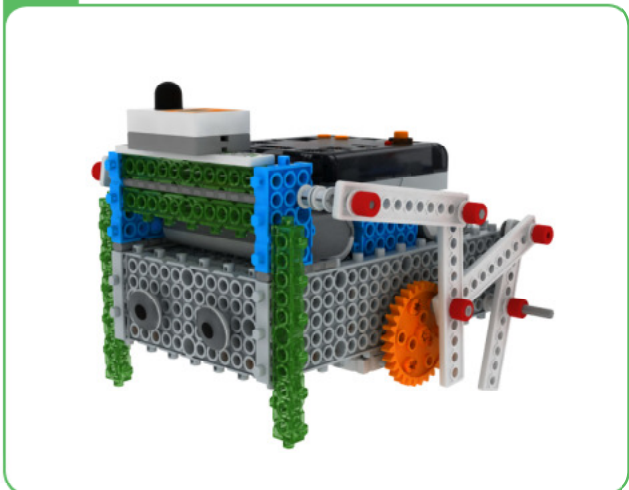
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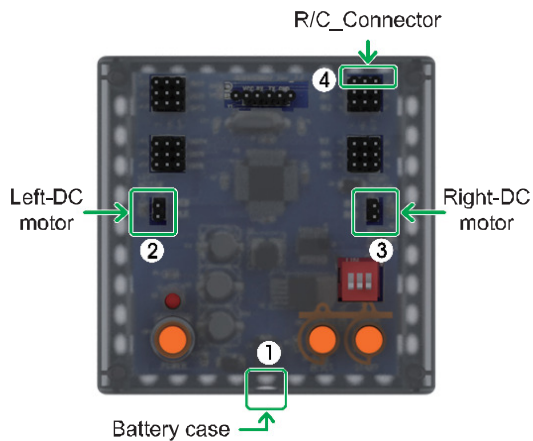
End





How to operate the Bug Battle Bot

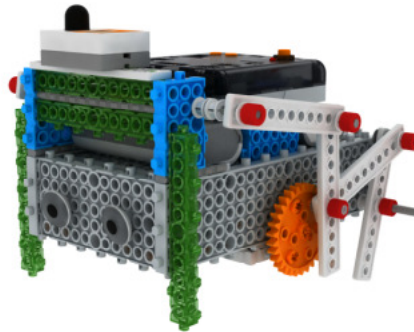
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect RC receiver board to R/C connector.

Motion Pattern/Program



Bug leg is along with the wheel movement.

※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on. (Power OFF → Power ON)

Program Example





Science

STEM 15. Running, action and reaction too!

1 Huna, do you know that the law of Action and Reaction is part of running?

2 Of course! I knew about that? Did you think of that while you were running?

3 No... I read about it in a book. How in the world does the law apply to running?

4 When we run, our feet push the ground. The ground in turn pushes our feet with the exact same force. And it pushes our feet in the opposite direction.

5 Aha! We are able to run because the ground is heavier than our feet, so the ground actually pushes us forward.

6 Great! Now, If the ground was lighter than our feet, our feet would have pushed the ground away.

7 Wow! If we were able to do that, then we will all become very strong!

8 Haha~ That might be true! Let's go find some examples of Action and Reaction!



Let's find what's the example of Action and Reaction law applying around us!



.....

S Science **STEM 16. Protecting the environment and creating sustainable energy sources -Green energy**

1 Huna! we installed a solar heating system in our house today!

Wow! your family did a great thing today!

2 Huh? solar? Why is it a good thing?

Of course, it's a good thing! Solar energy doesn't pollute the environment unlike fossil fuels we have talked about earlier.

3 Uh~ I've heard about it before, but what's green energy actually?

Because fossil fuels cause so much environment pollution, we had to find ways to replace these disappearing fossil fuels.

Oh, I understand. what other sources of green energy? Do we have besides solar energy?

Wind, water.. wind generates energy by turning a propeller into motion.

Water generates electricity when it falls from high in water falls.

5 These are power plants. On the left is wind, the right, water.

6 Peter, and haven't you seen of the water car or the solar car?

Ah! yes, I've seen them before. I can see that we are trying really hard to protect our environment.

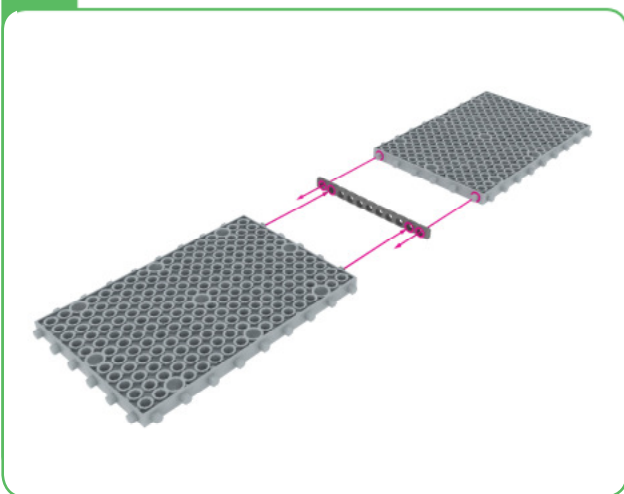
So, let's try even harder to protect our environment.

7

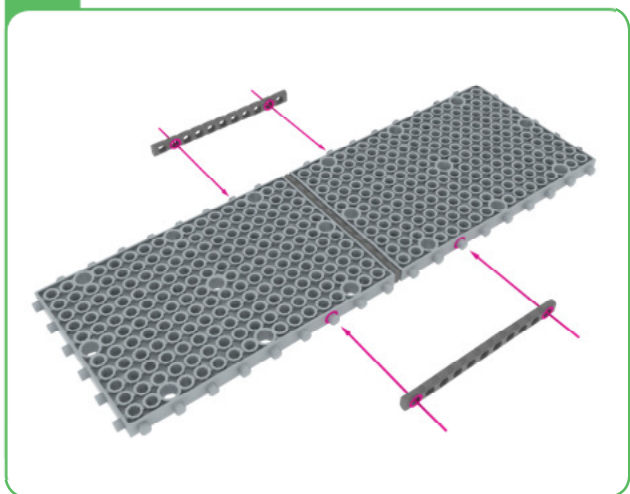
T Technology
E Engineering
Robot Making 9-Cleaner Robot



1

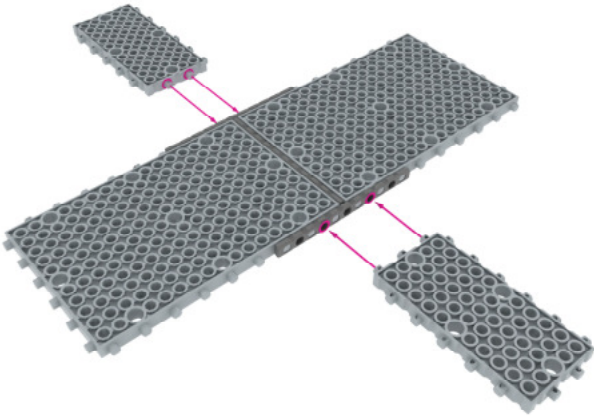


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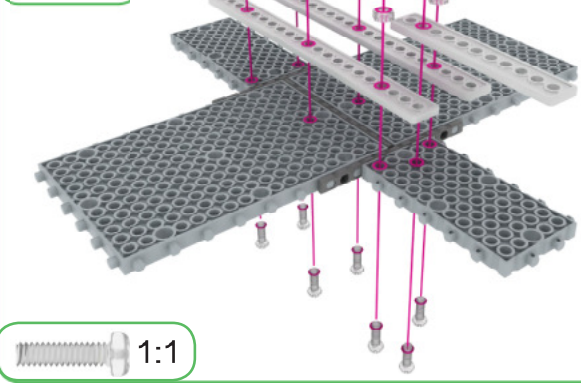
Intermediate Level

3

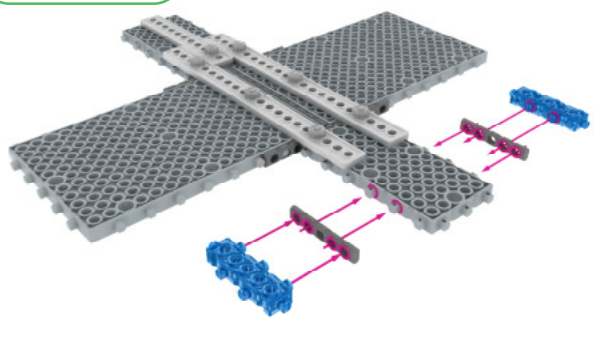
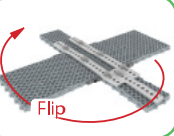


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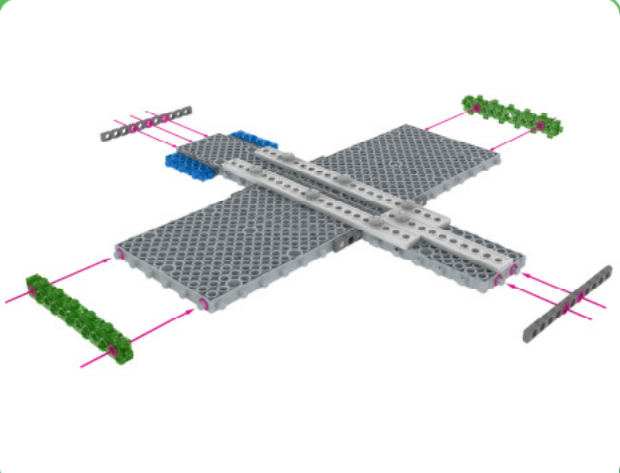
X7
X7



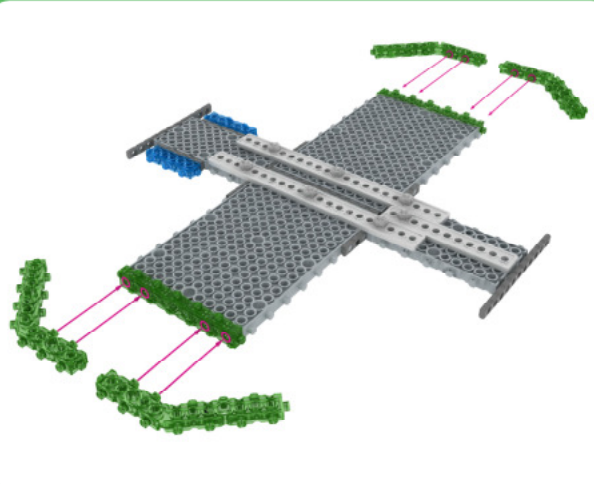
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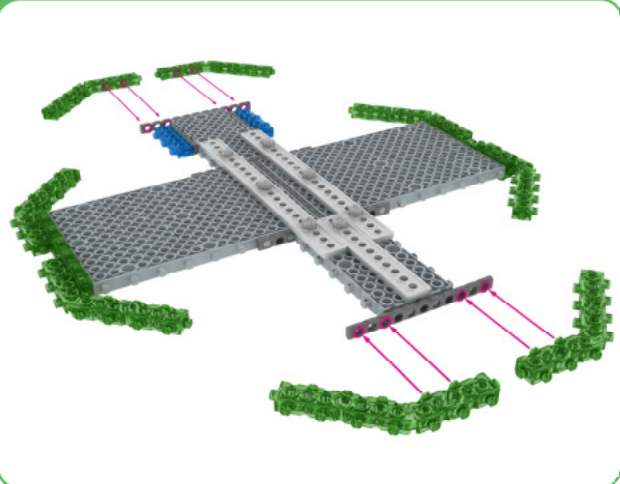
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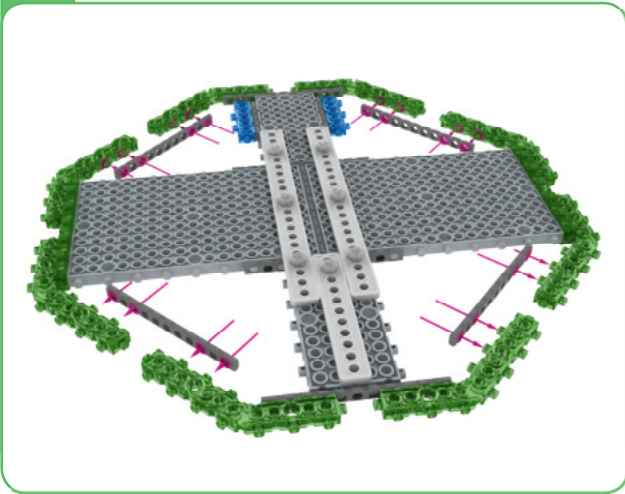
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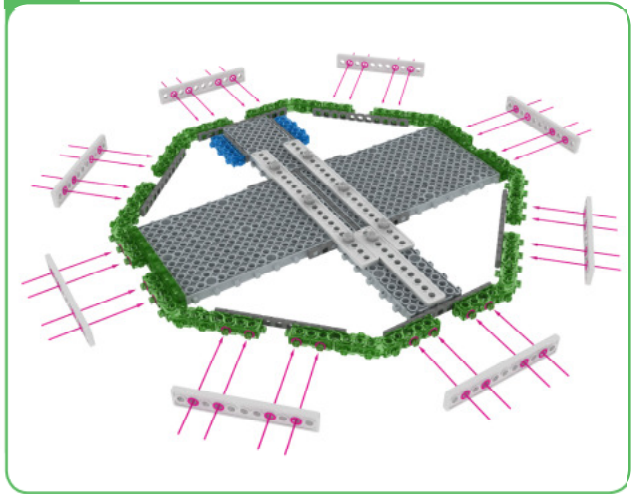
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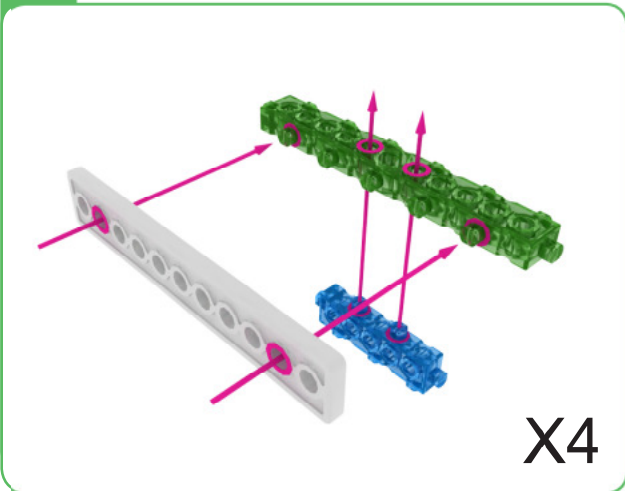
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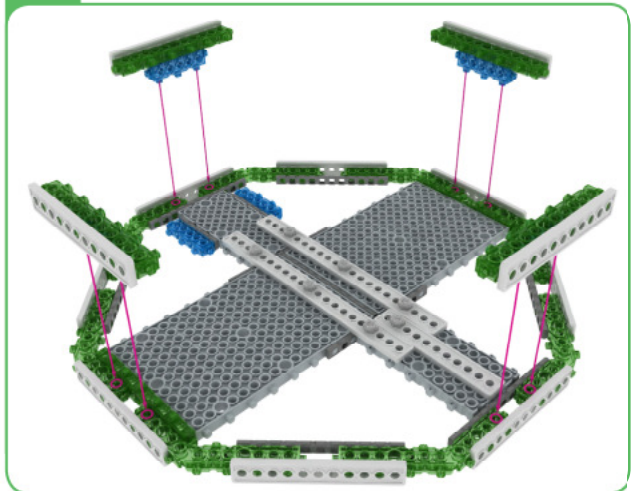
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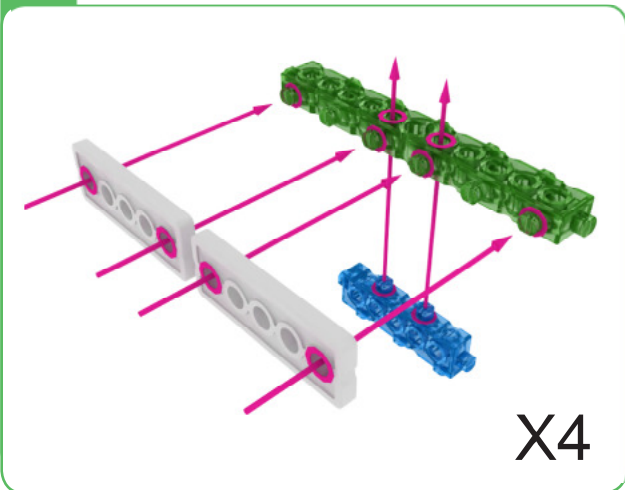
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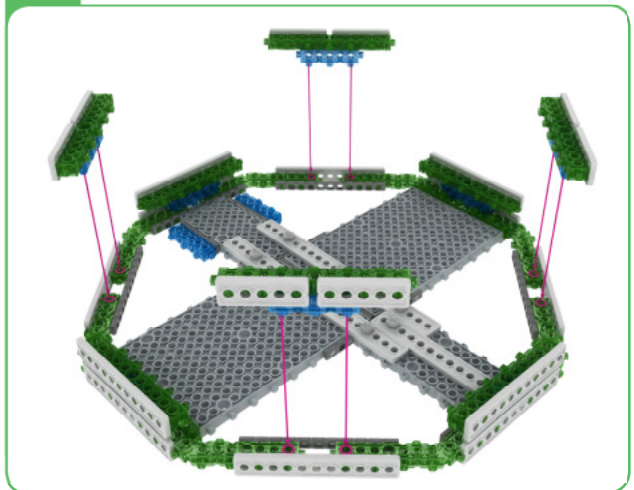
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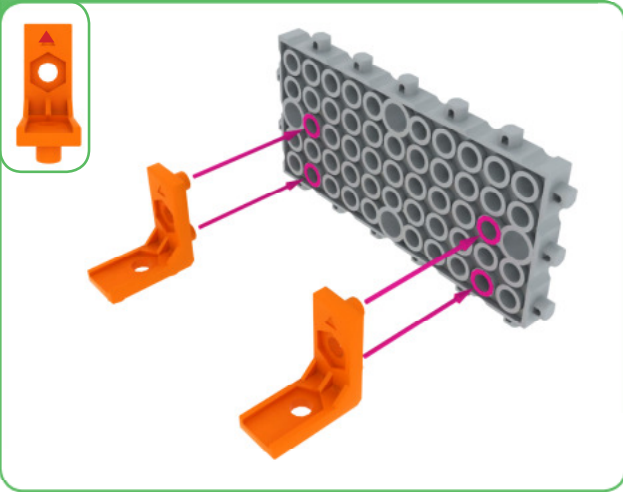
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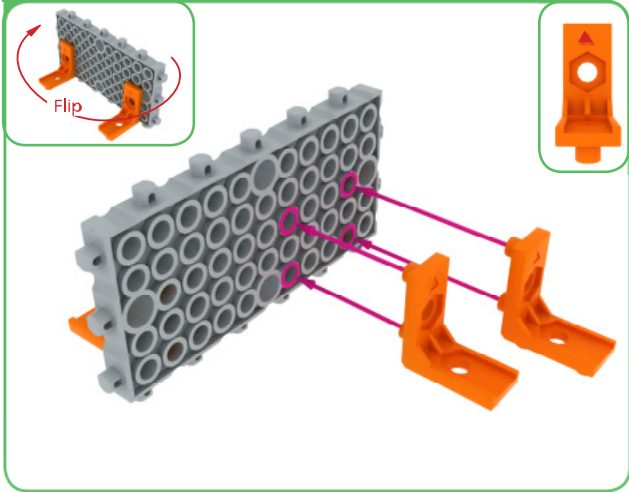
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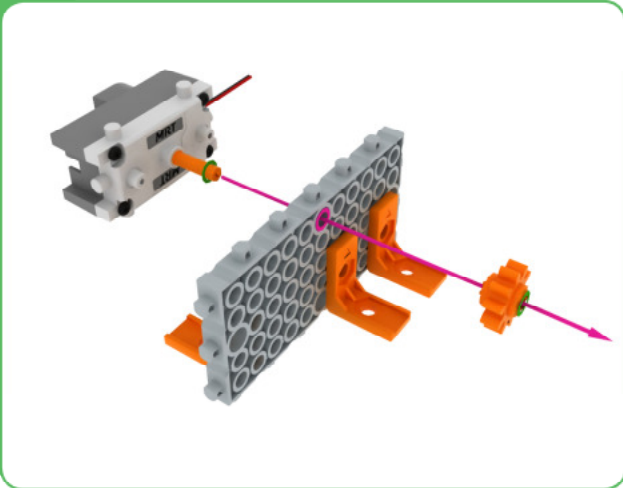
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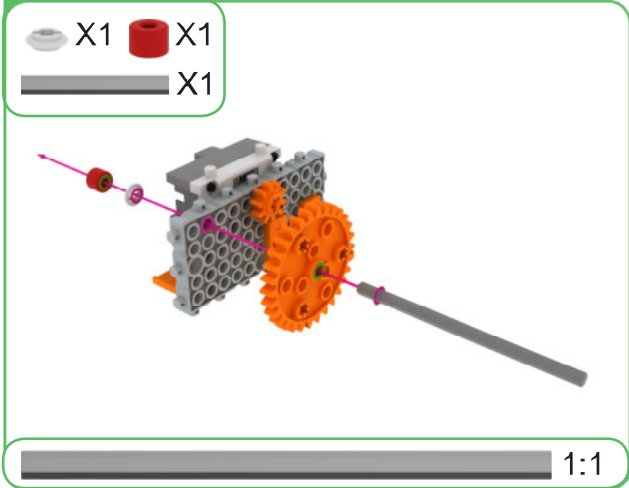
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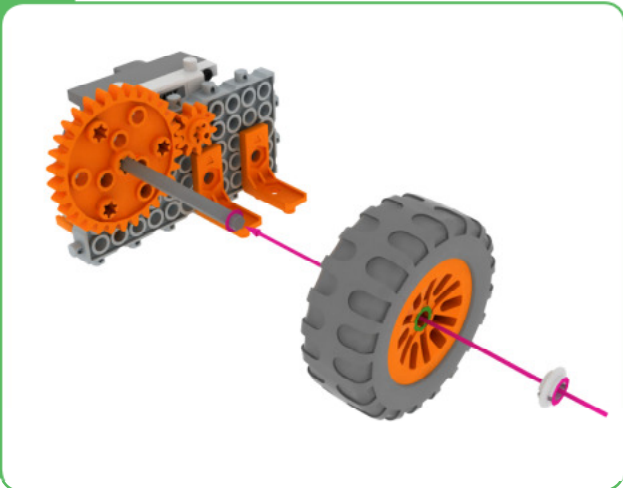
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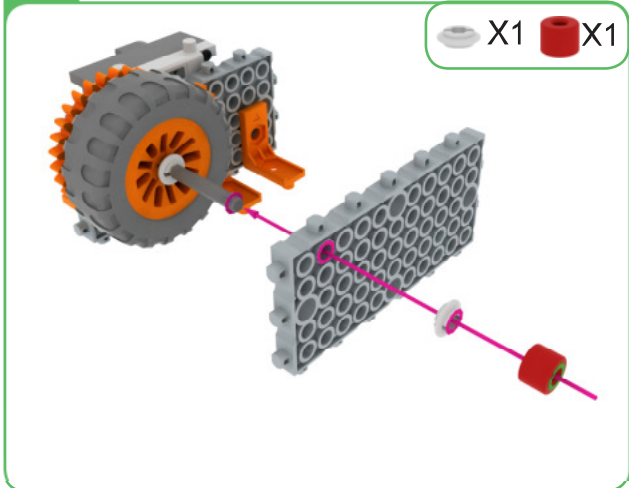
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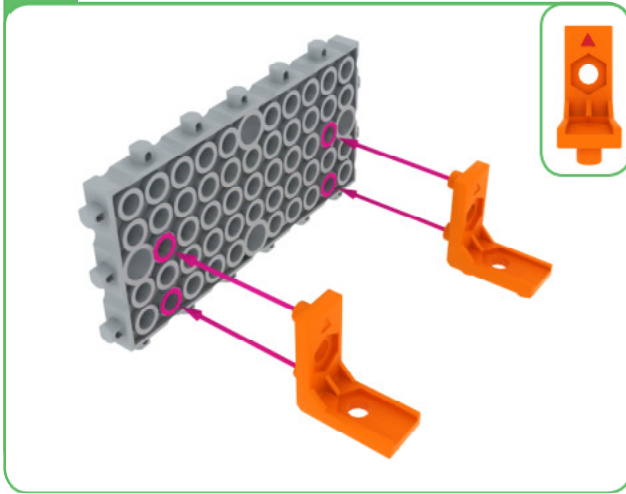
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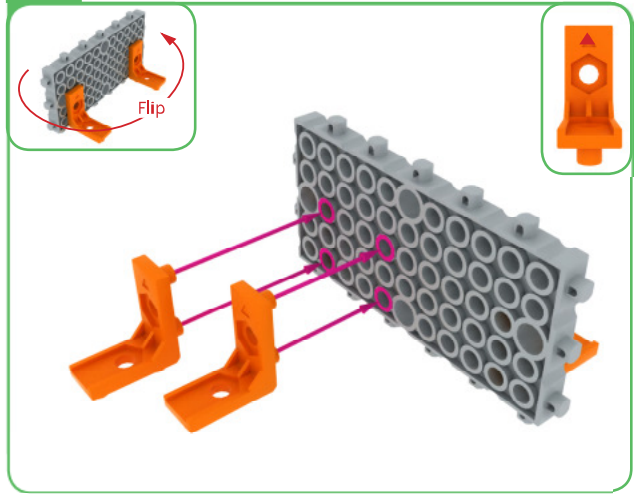
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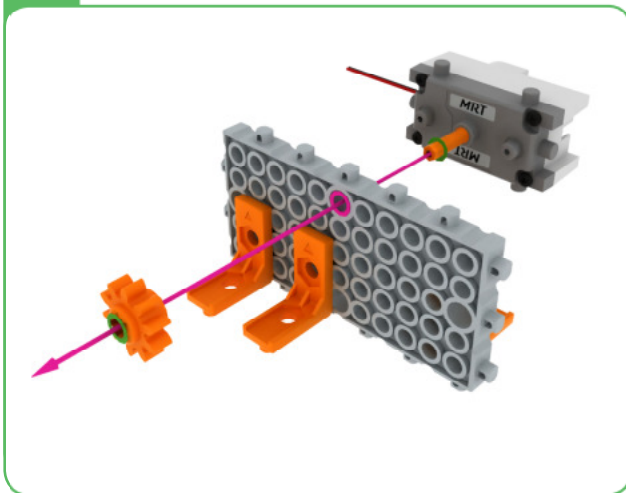
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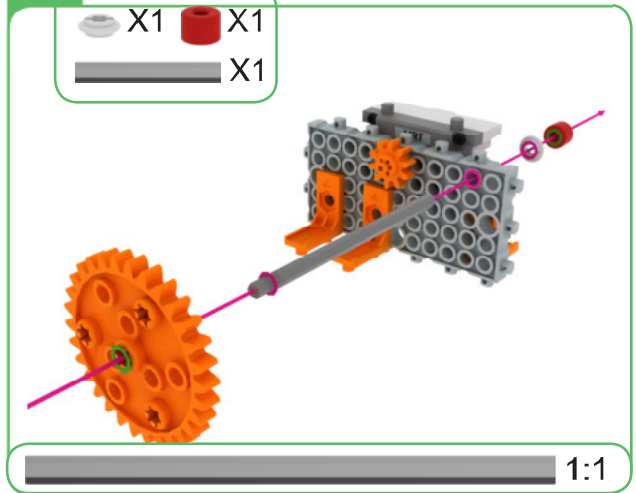
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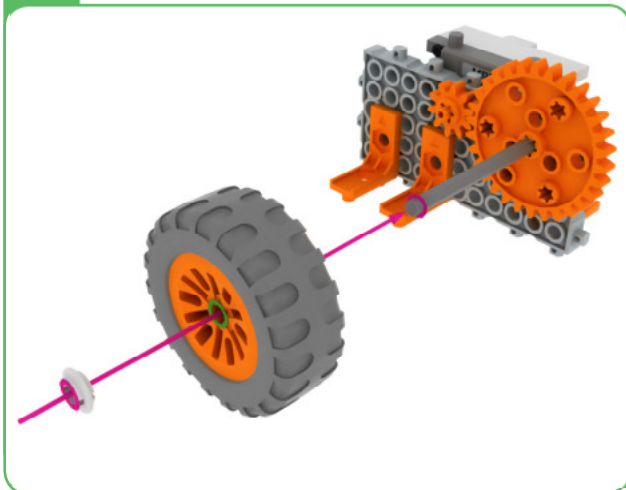
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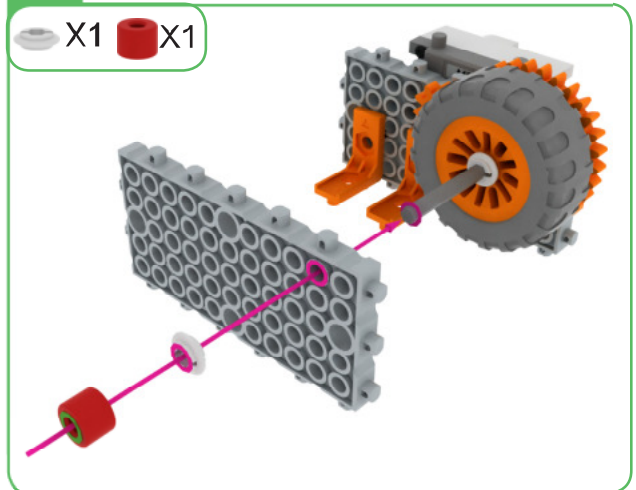
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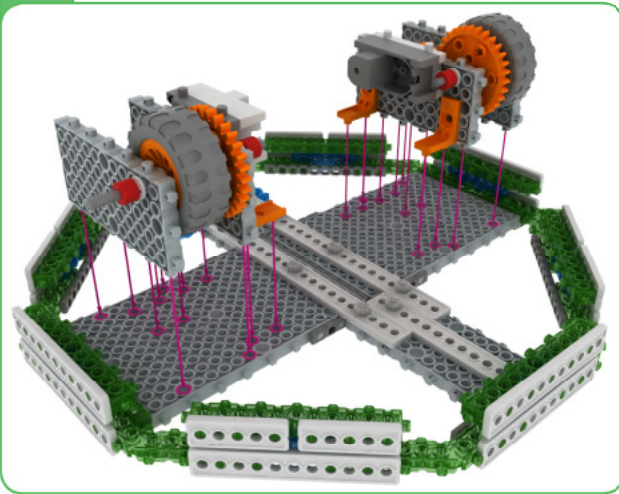
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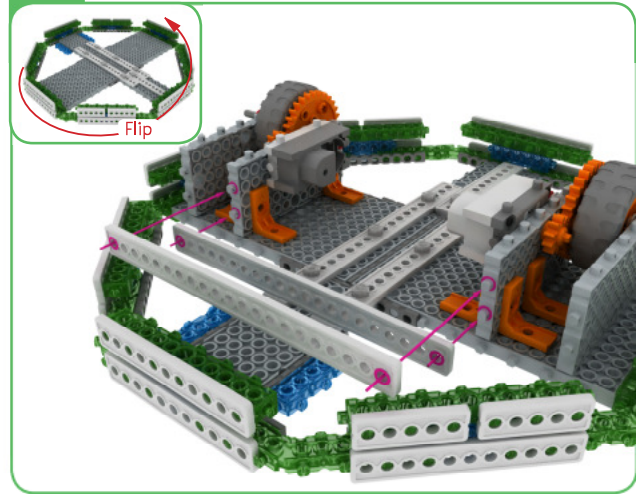
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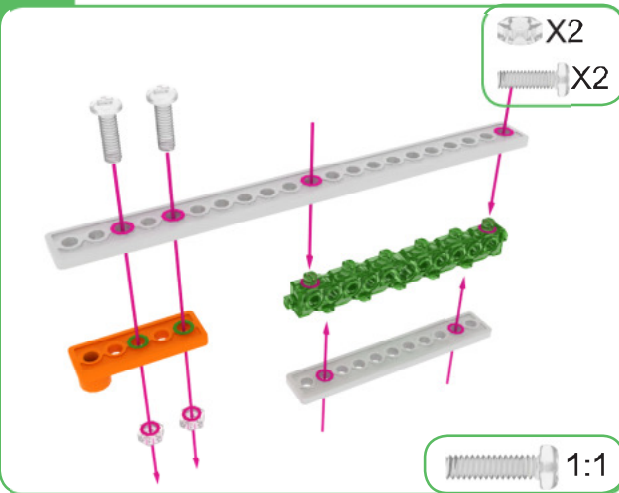
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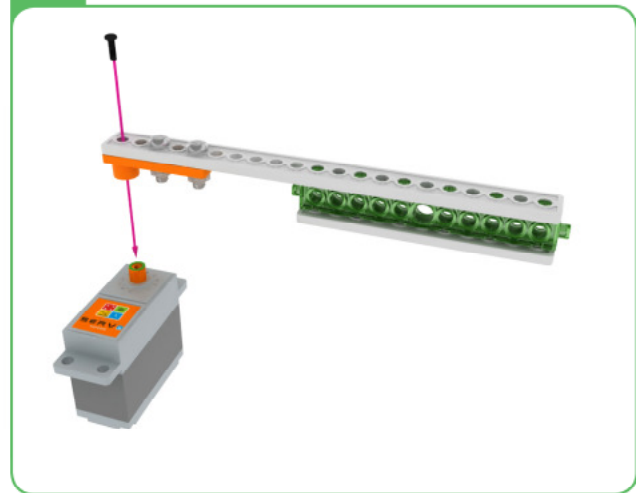
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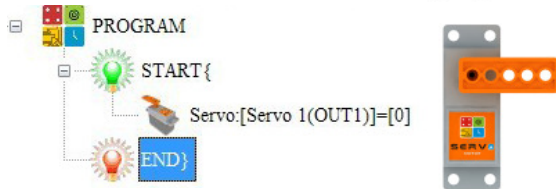


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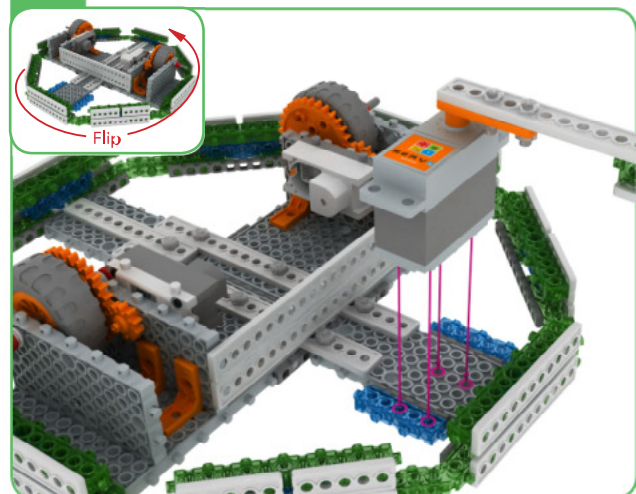
Servo Motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. You can write the program in the following way.

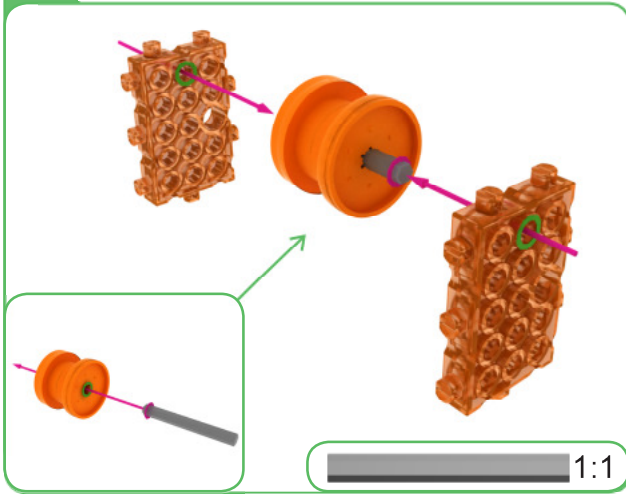


2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

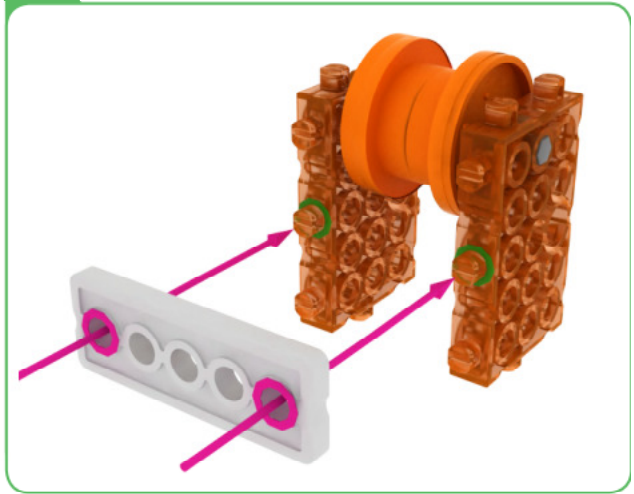
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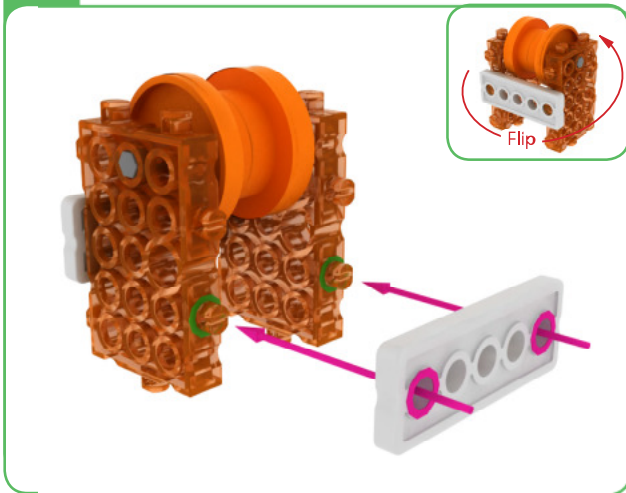
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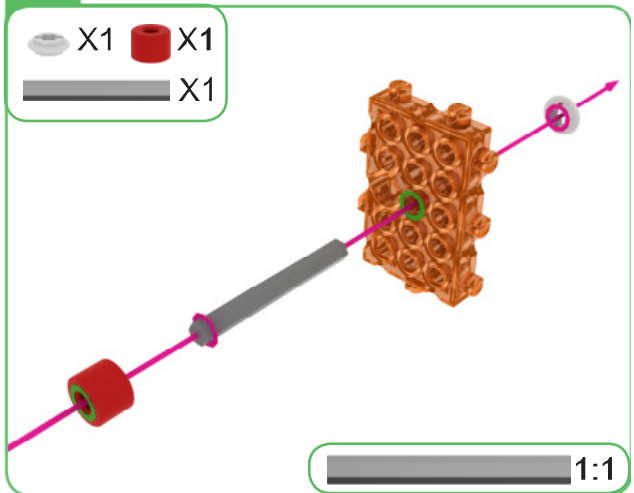
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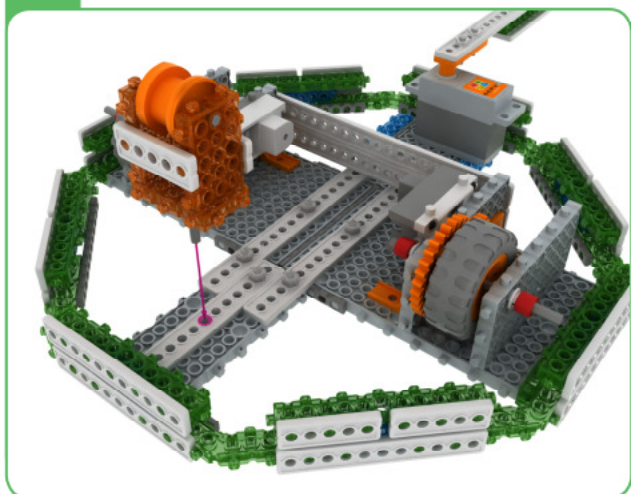
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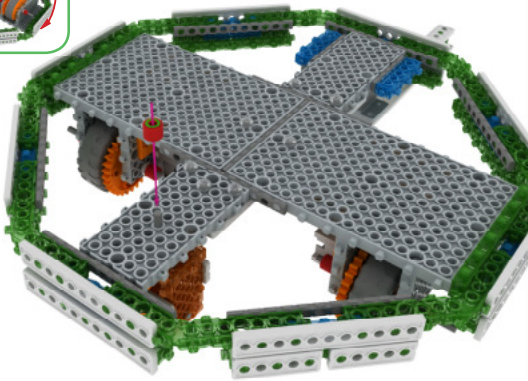
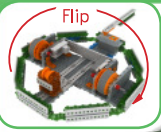
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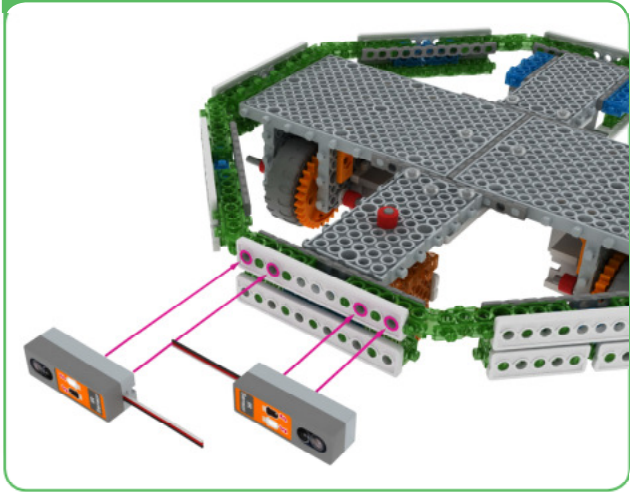
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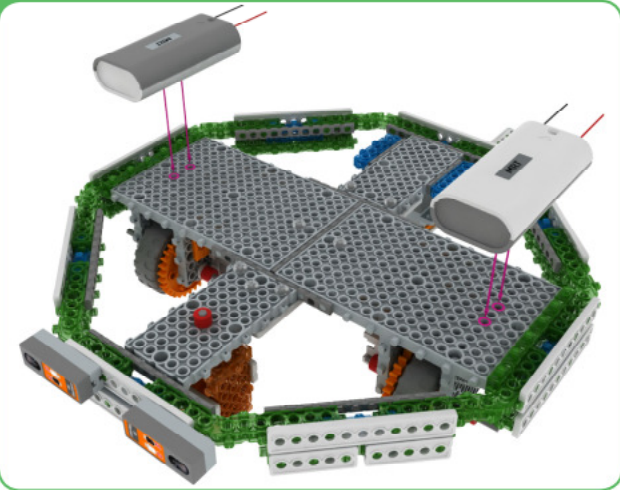
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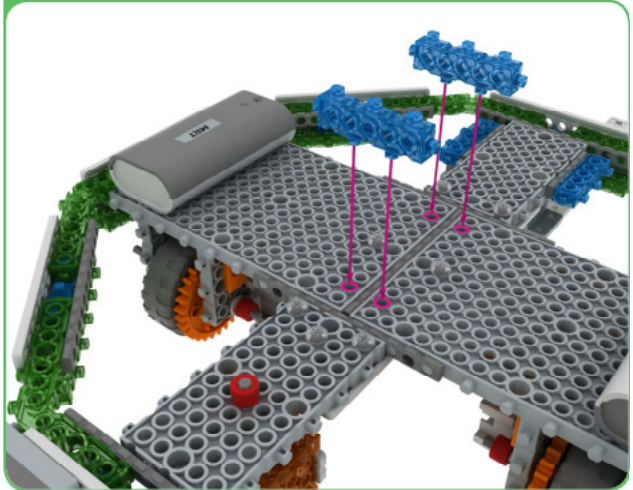
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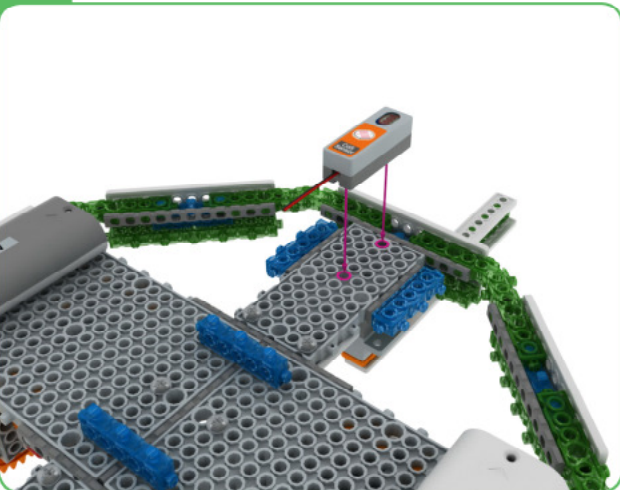
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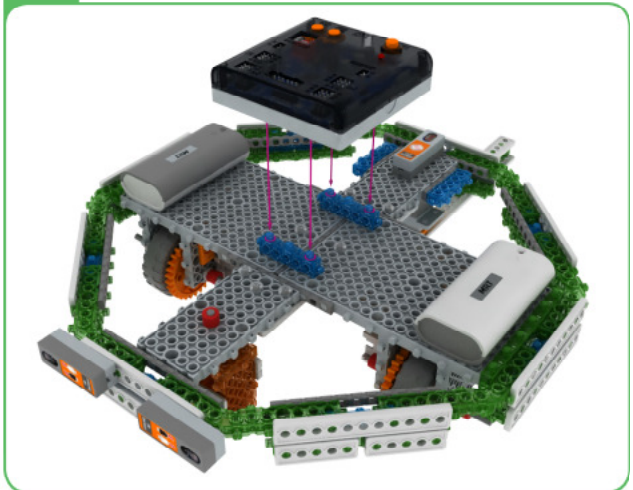
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42



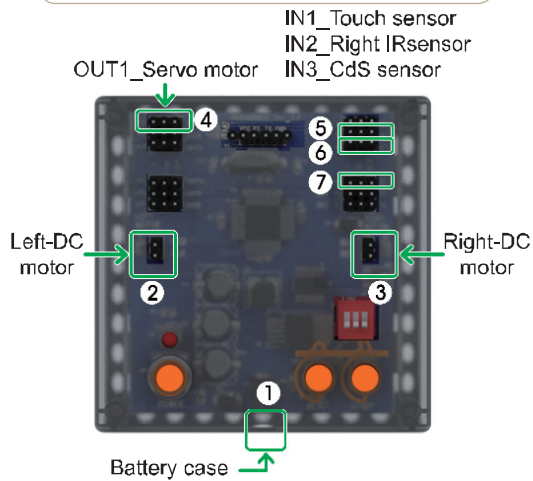
End





How to operate the Cleaner Bot

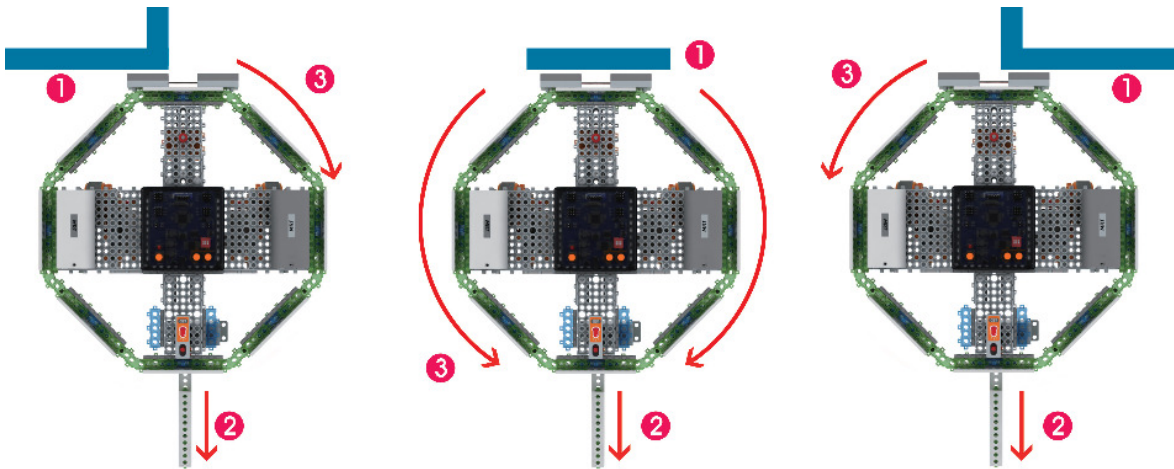
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect Left IR sensor to IN1 of INPUT connector.
6. Connect Right IR sensor to IN2 of INPUT connector.
7. Connect CdS sensor to IN3 of INPUT connector.

Motion Pattern/Program

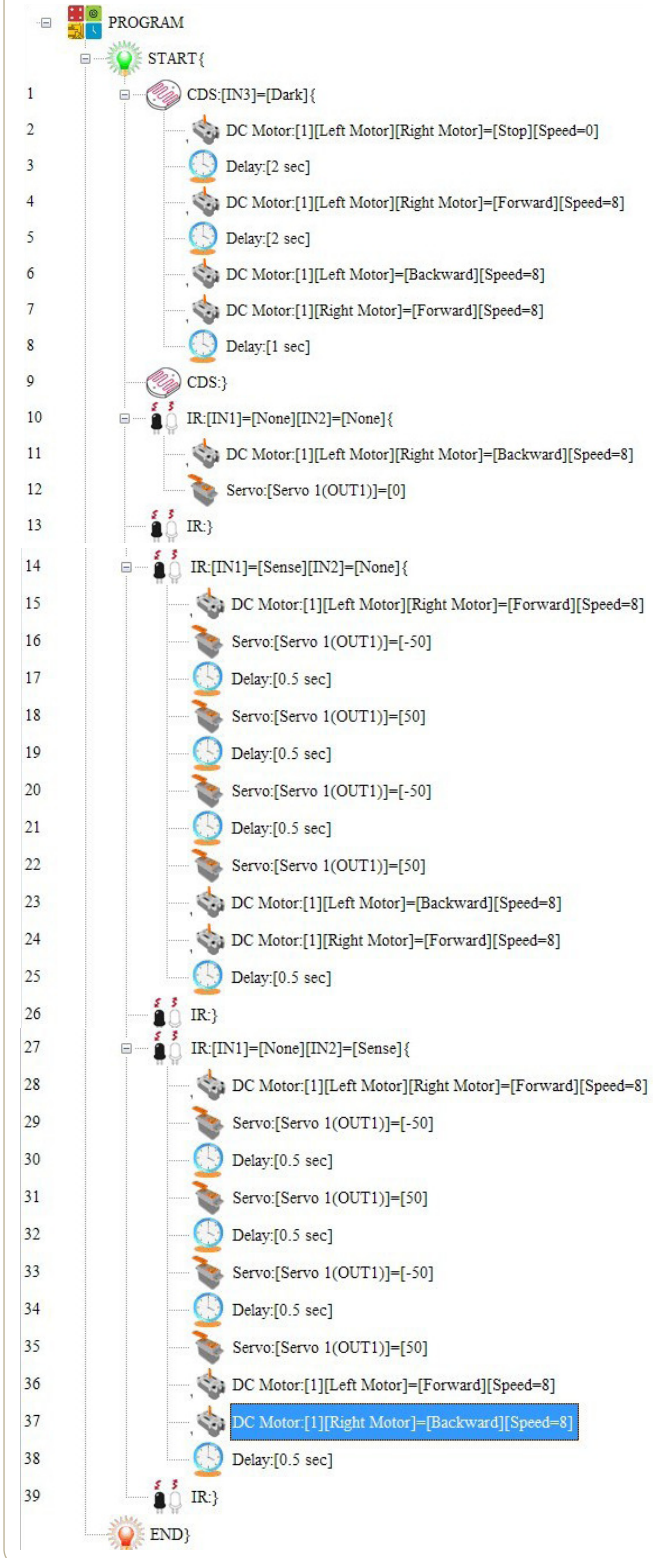


※ - Using the motion patterns as reference, let's write the program.

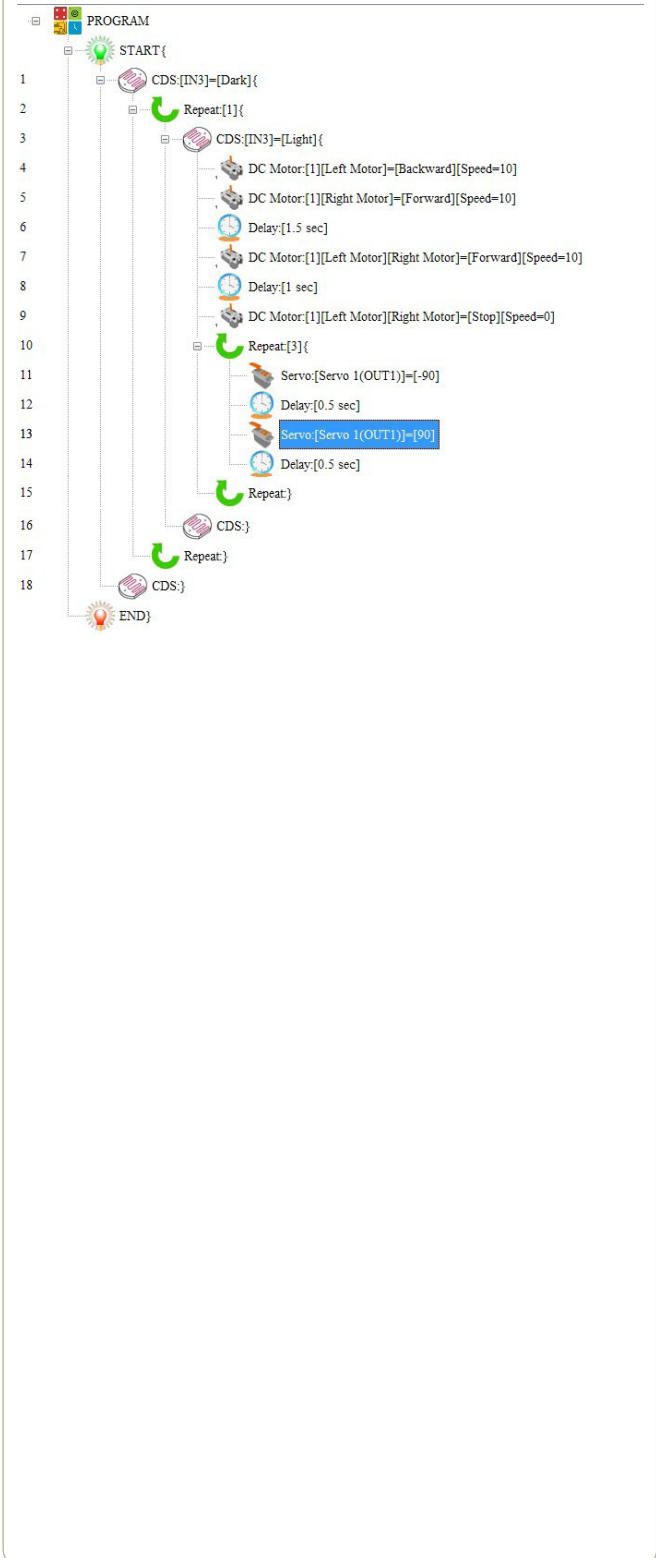
Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on. (Power OFF → Power ON)

Program Example



Program Example



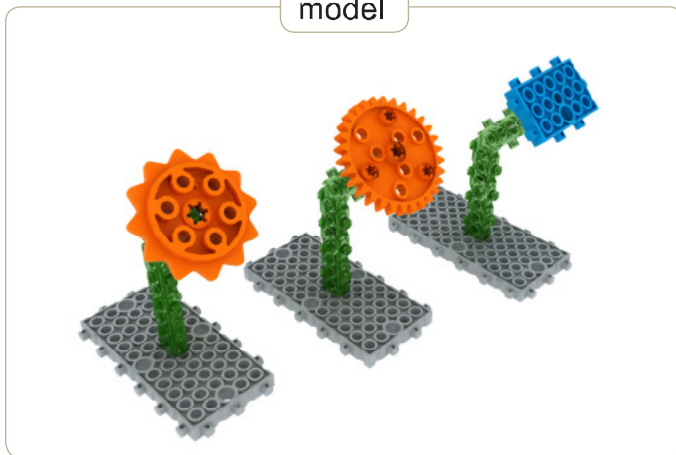


Art

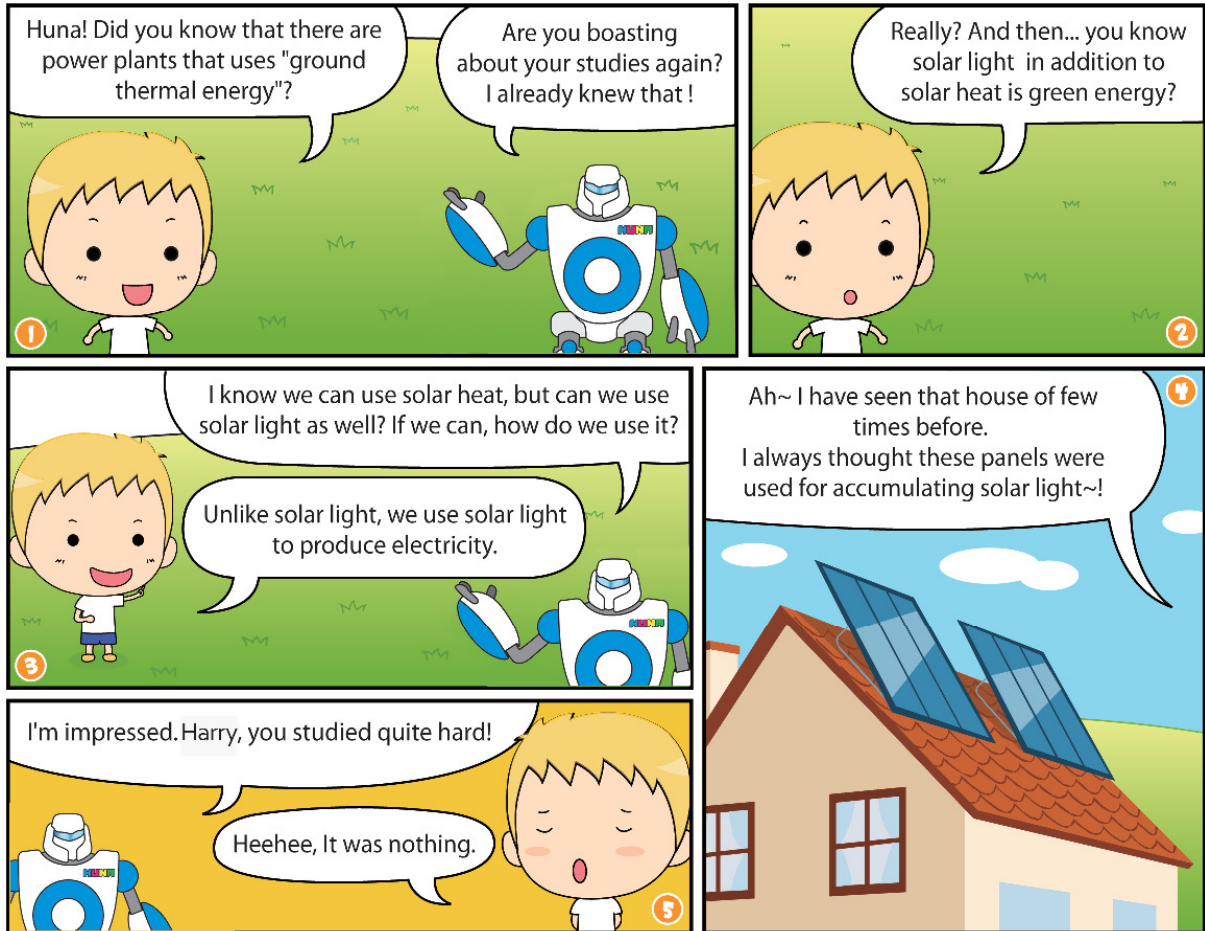
Let's play games to use cleaner robot!

1. Make some small models with the blocks.
2. Put the small mode into different place ,and put the cleaner robot in the center.
3. Use your hand to touch the CDS sensor,the robot will follow your hand.
4. when cleaning robot encounters to the models,this model is eli minated.
5. Let's check who are the winner.

model



S Science **STEM 17. There is green energy everywhere around us!**



Let's see what other things we can find that uses green energy as a energy sources.

A spiral-bound notebook page with a light blue cover and several horizontal lines for writing.



Science STEM 18. The incredible power of thing in higher positions -Potential energy

1 Hey, Huna! I saw on TV how water eroded rocks and boulders.

2 Water has not force, but it eroded a hard rock?

3 Yes, because the water fell from a higher position, it eroded the boulder over time.

4 Aha~ that's potential energy.

5 What's the potential energy? Dose this energy have a position?

6 Haha... no ~. When something is in the high position, then it has potential energy.

7 Right! You saw how water can get even more power when it falls from an higher position. That is how it erodes boulders.

8 This is a typical example of water's potential energy.

9 So, does that mean,.. the higher an object goes, the stronger it's force will become?

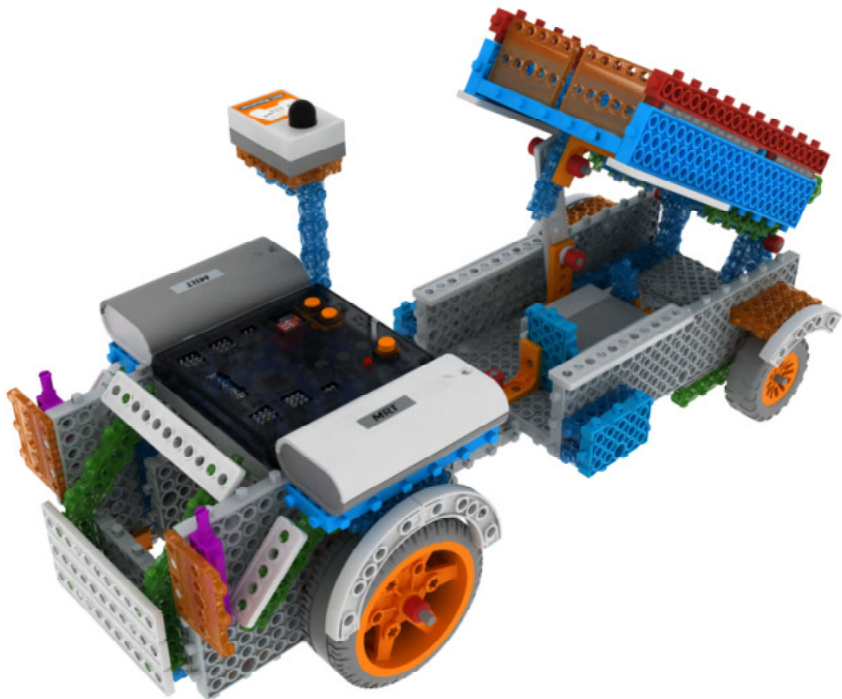
10 Yeah, I know that! And as water from high to low, we can use this force to produce electricity, can't we?

11 Yeah, that's right! Water power plants are usually build in the slopes and waterfall of mountain that have much water. Potential energy makes the original force of water much stronger.

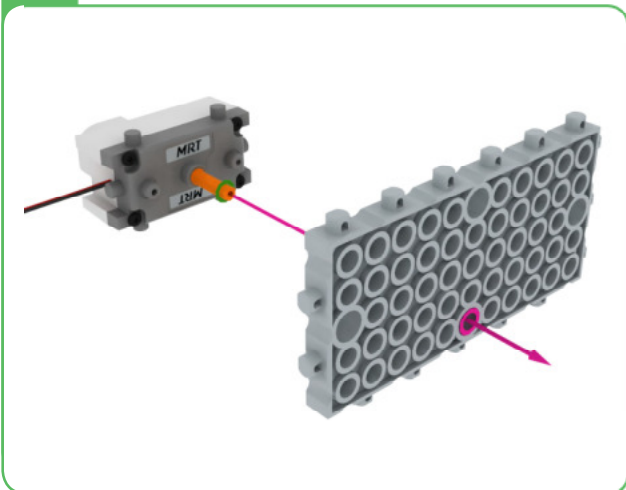
12 Wow, they were really clever to combine the power of water with potential energy!

13 And it doesn't even pollute our environment! It's one of our best resources.

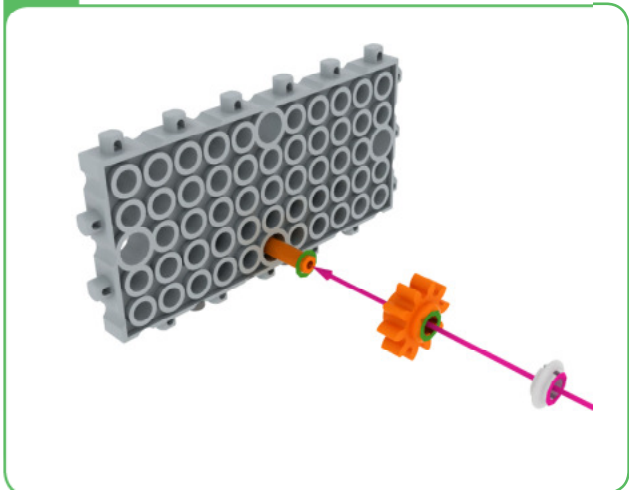
T Technology
E Engineering **Robot Making 10-Dump Truck**



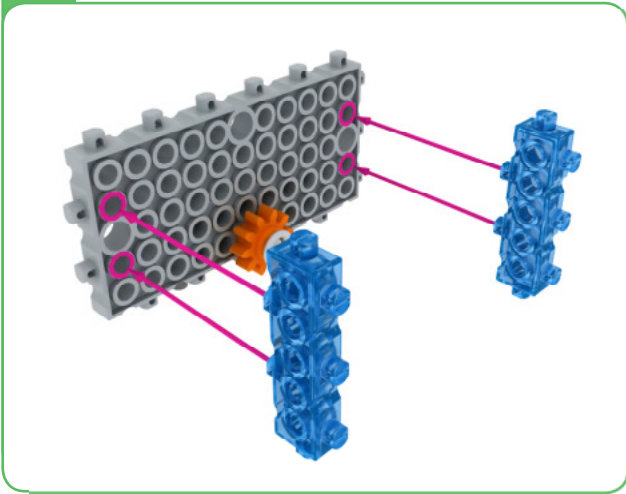
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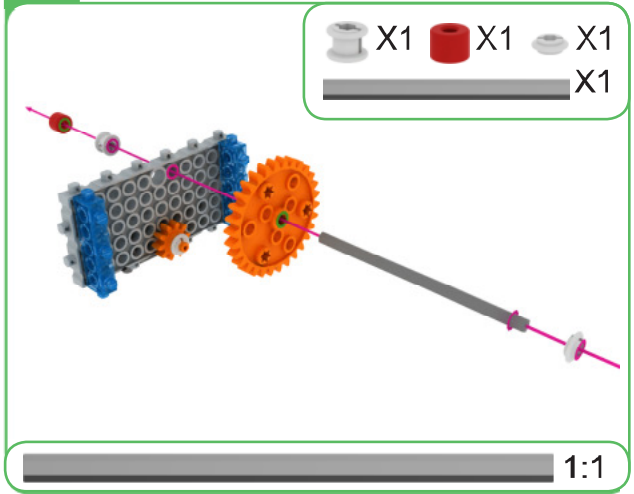
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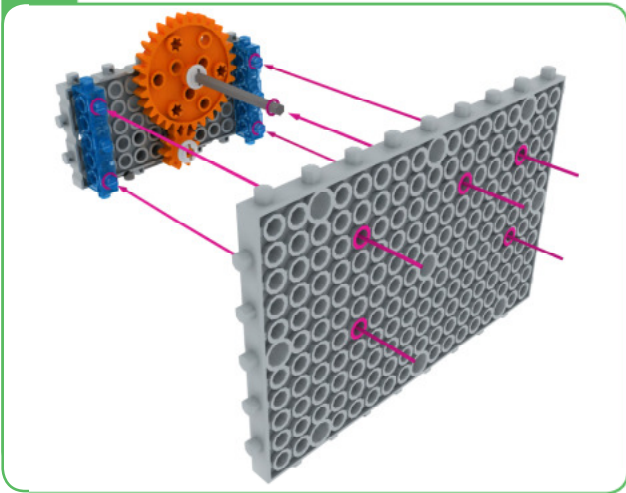
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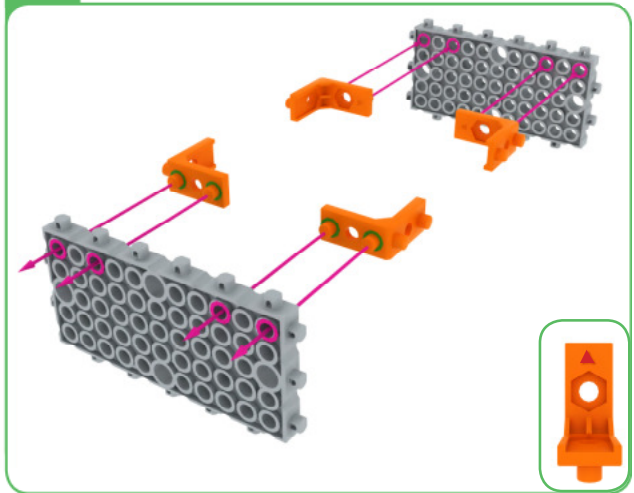
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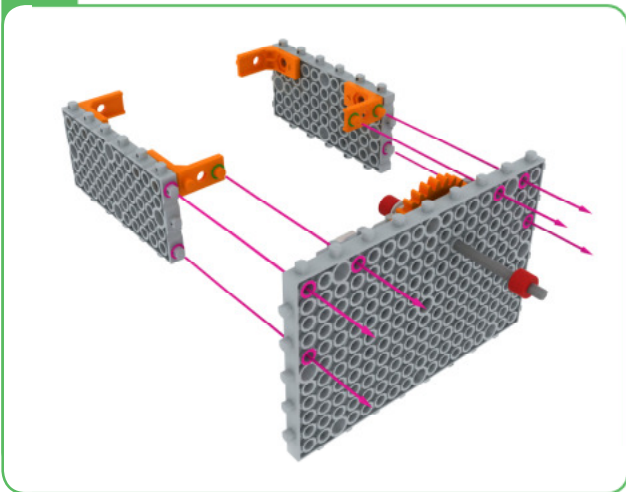
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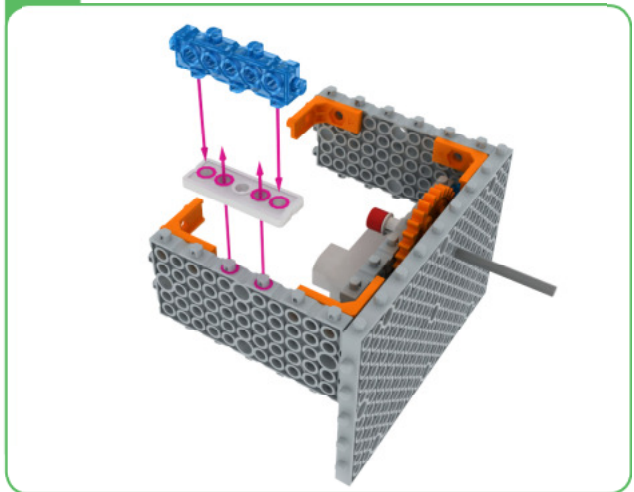
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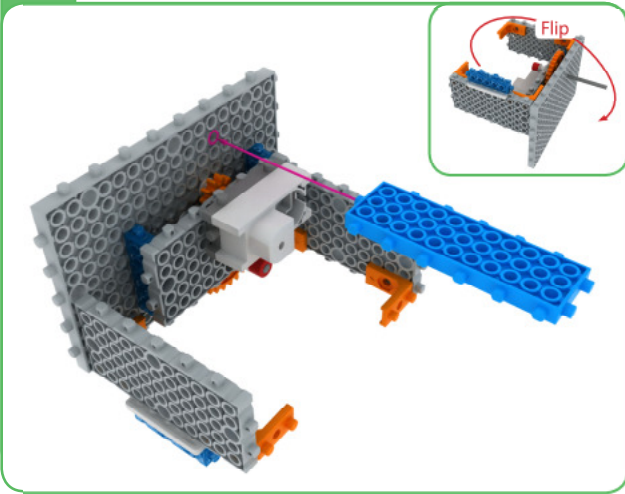
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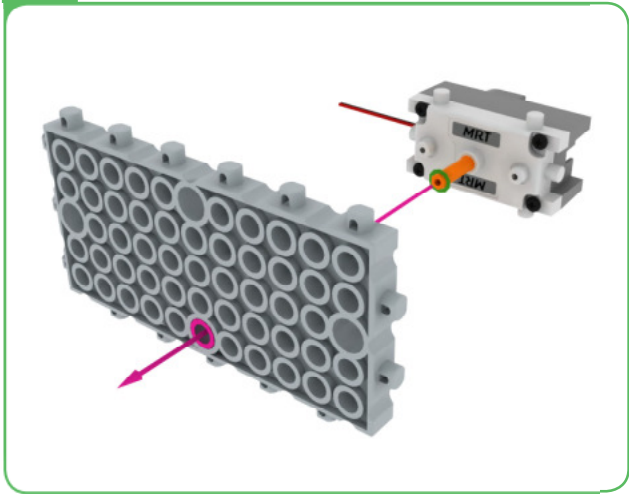
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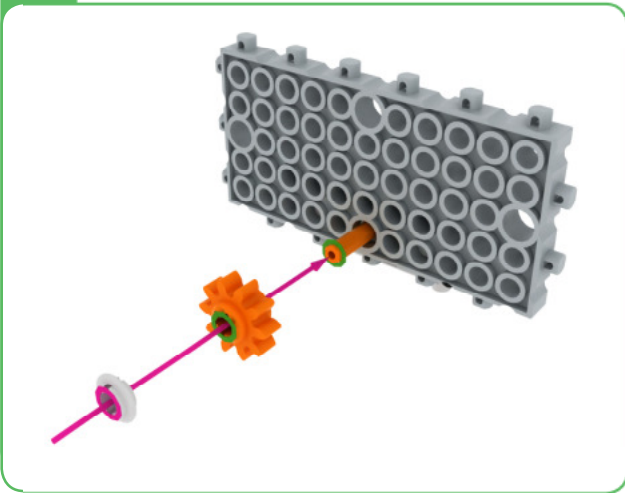
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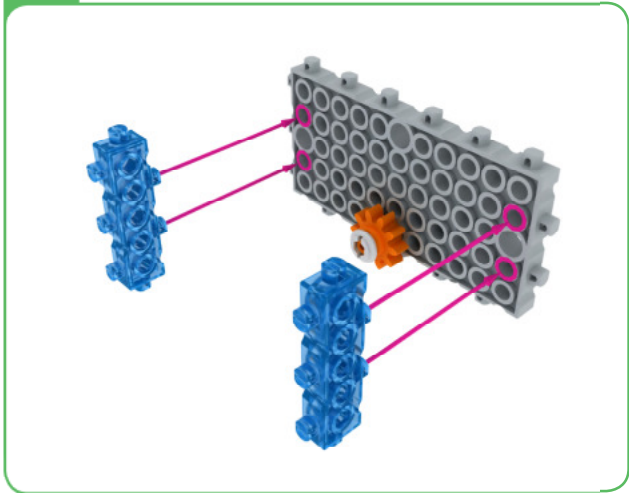
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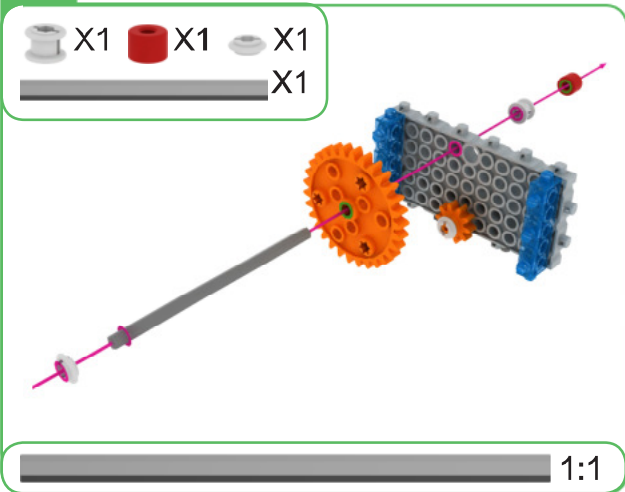
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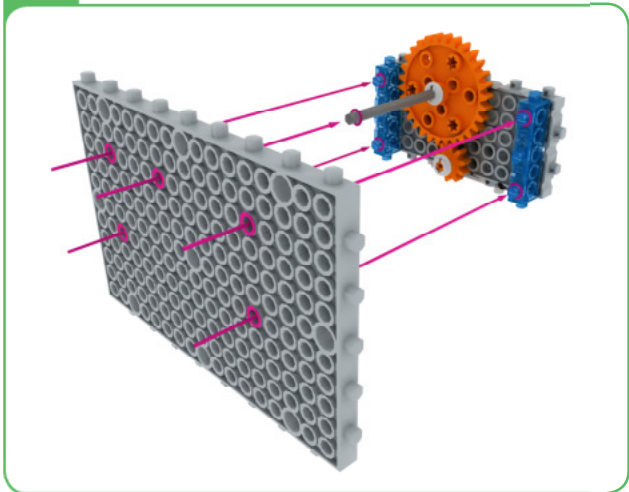
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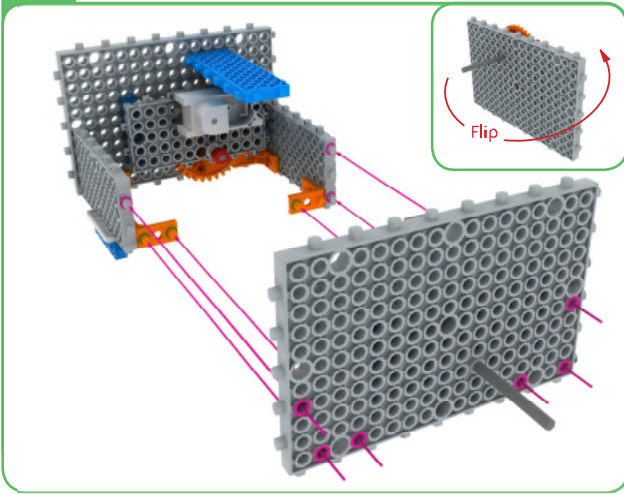
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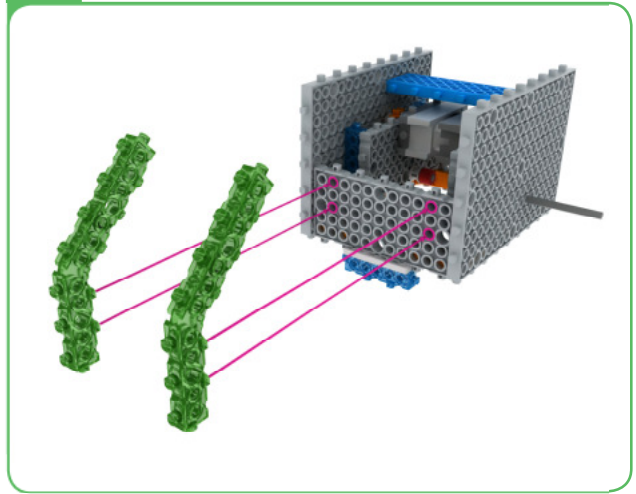
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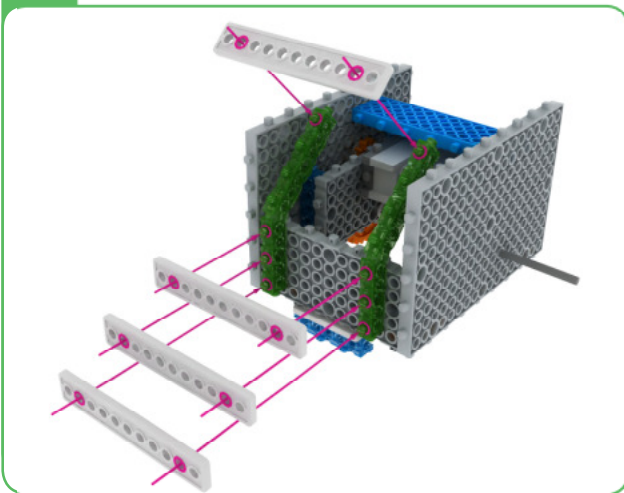
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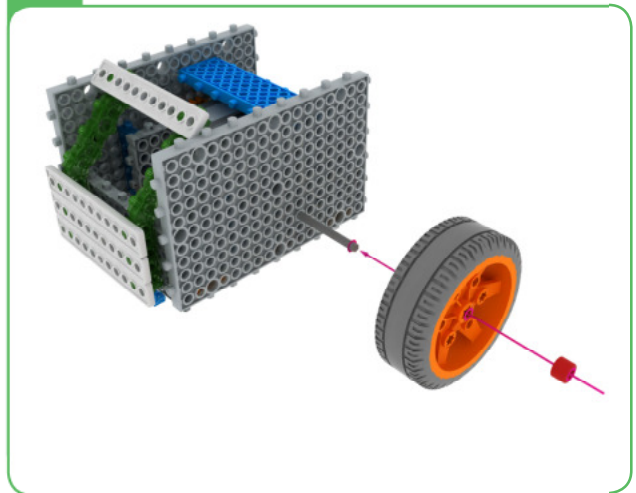
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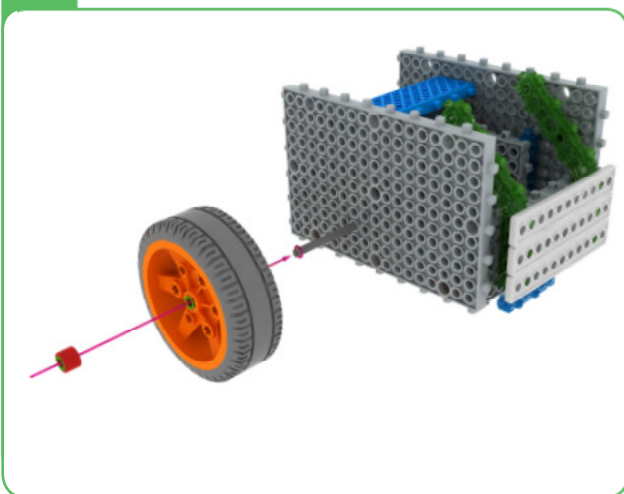
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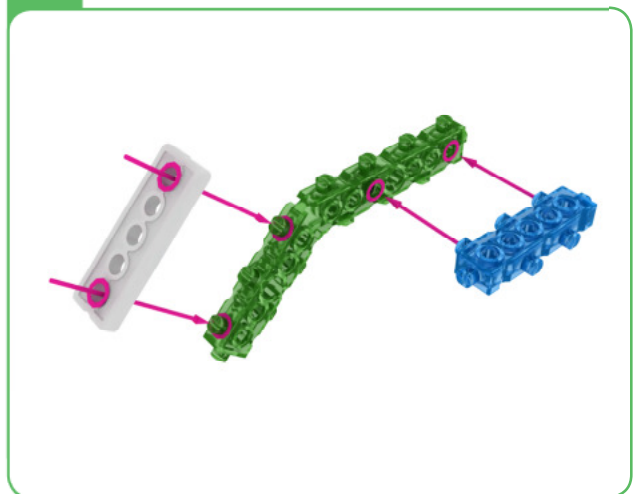
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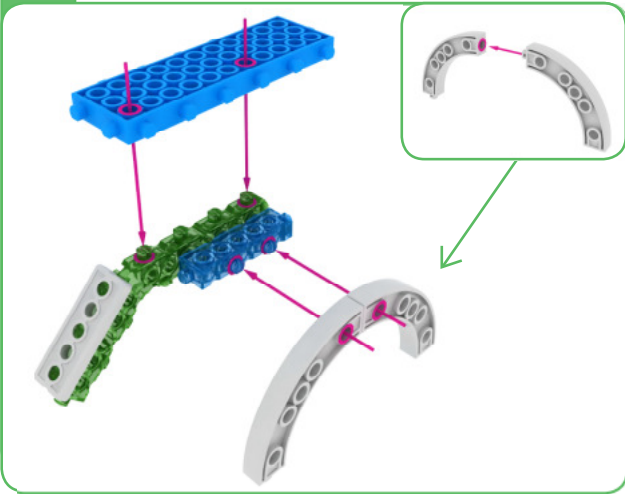
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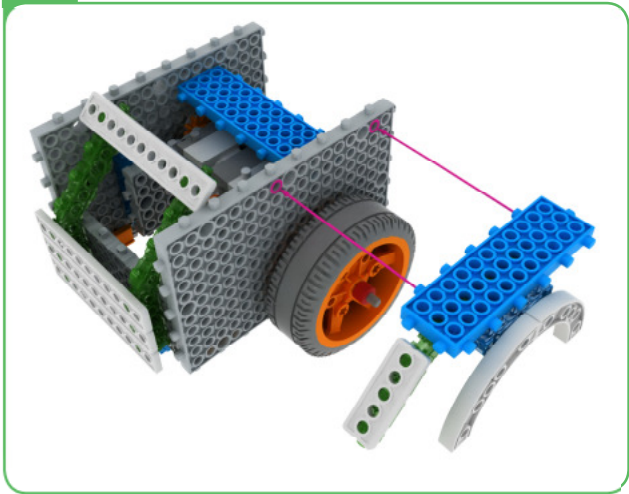
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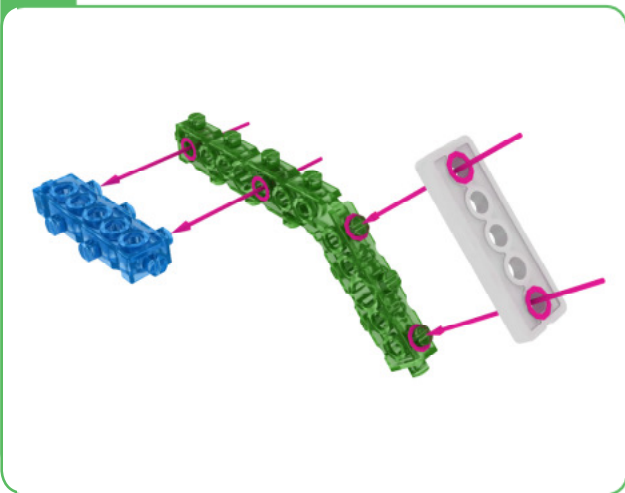
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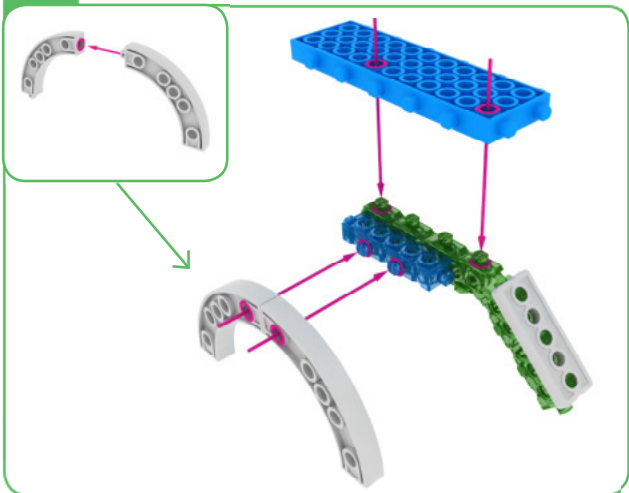
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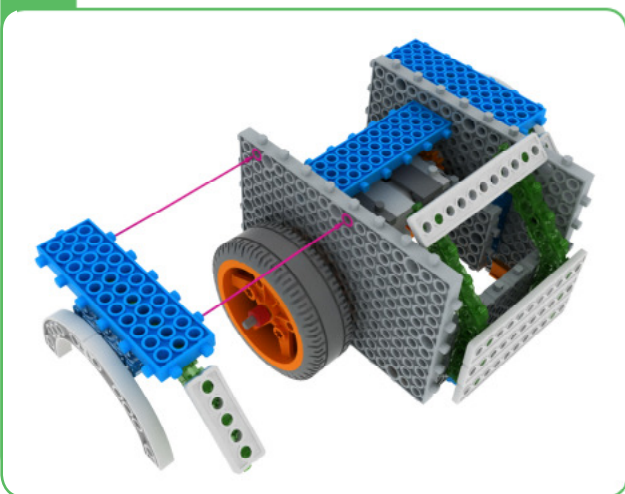
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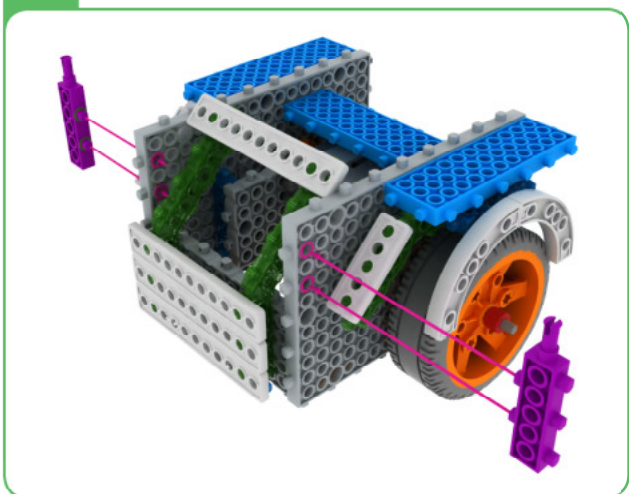
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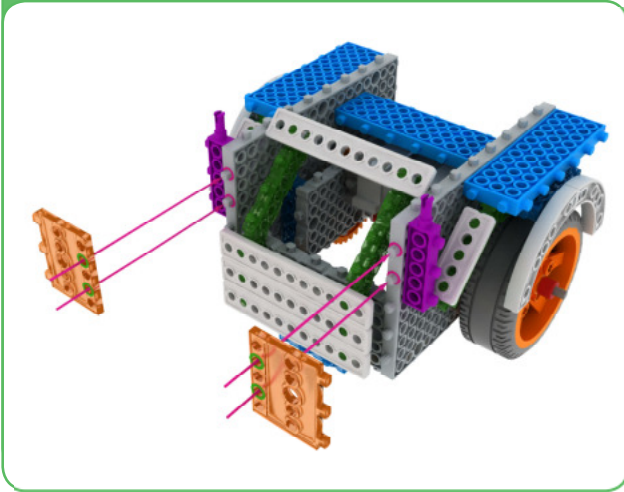
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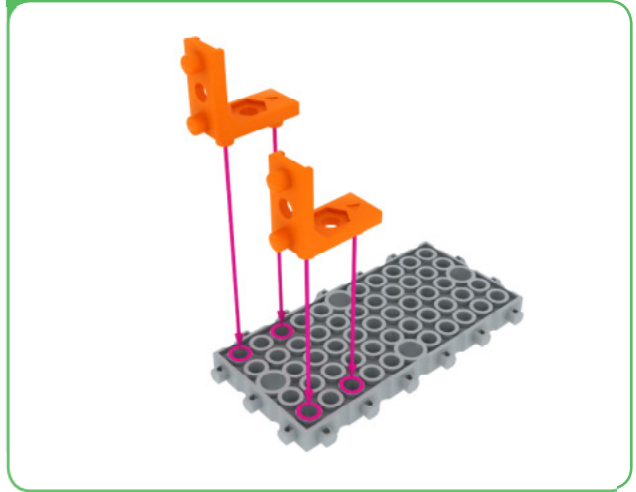
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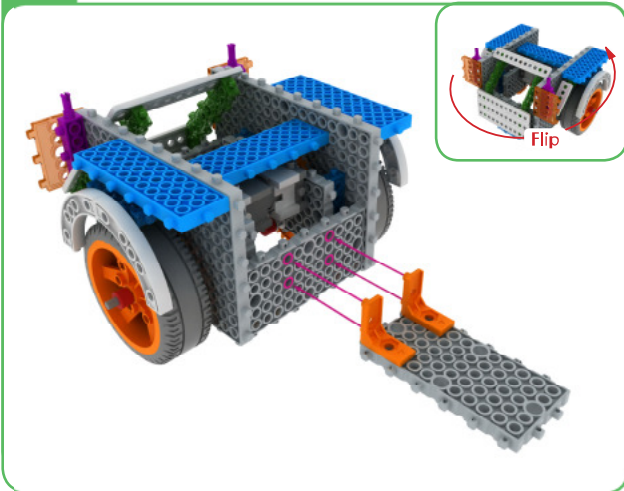
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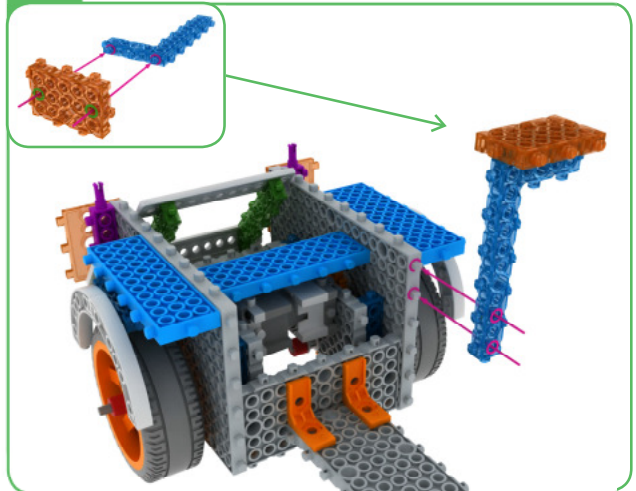
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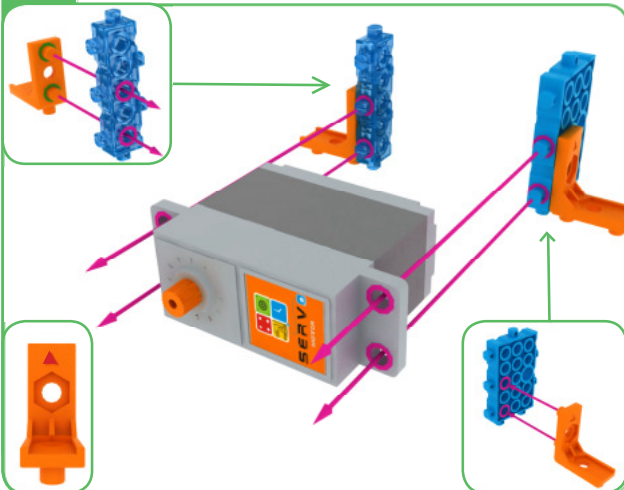
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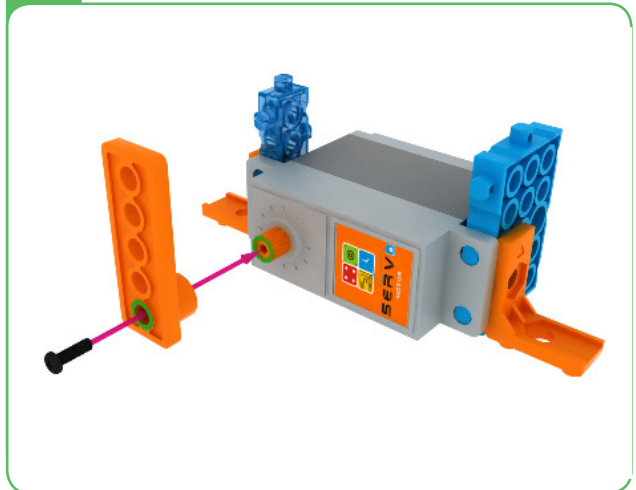
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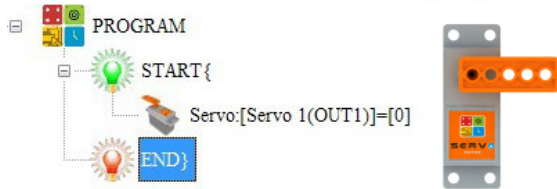


32



Servo Motor-Zero Point Adjustment

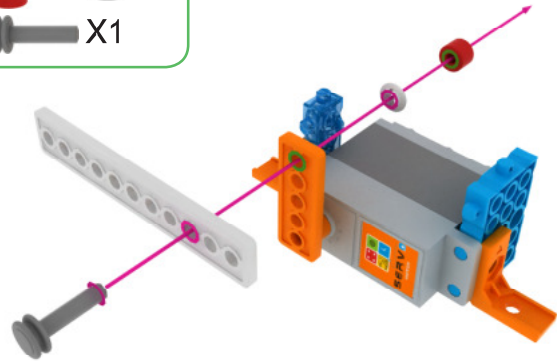
1. Connect the servo motor to the mainboard. You can write the program in the following way.



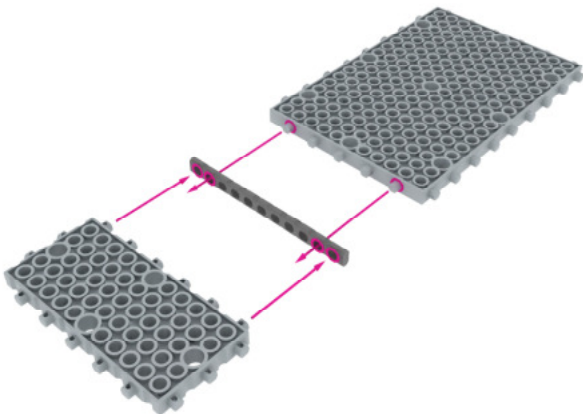
2. After downloading the program, power off and on again.
3. Fix servo motor horn to the servo motor with a small servo bolt as illustrated in the picture .

33

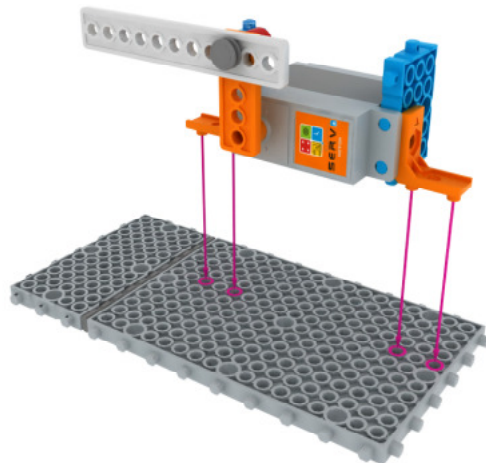
- X1
- X1
- X1



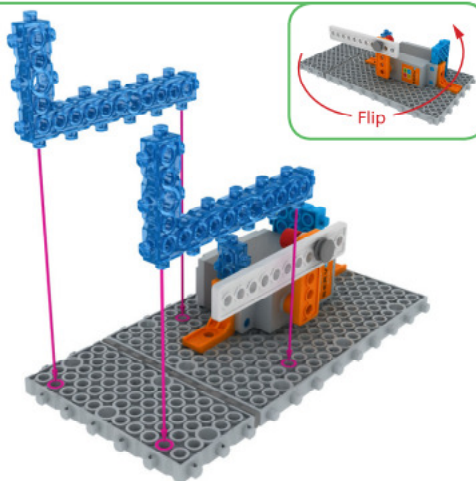
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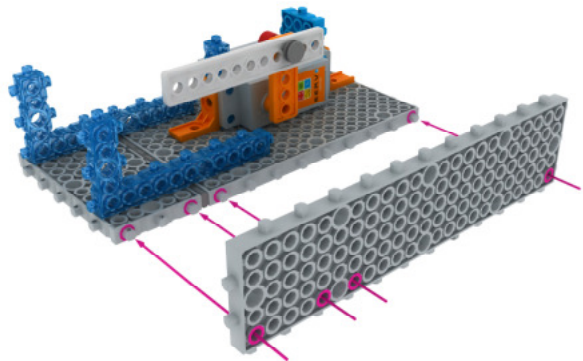
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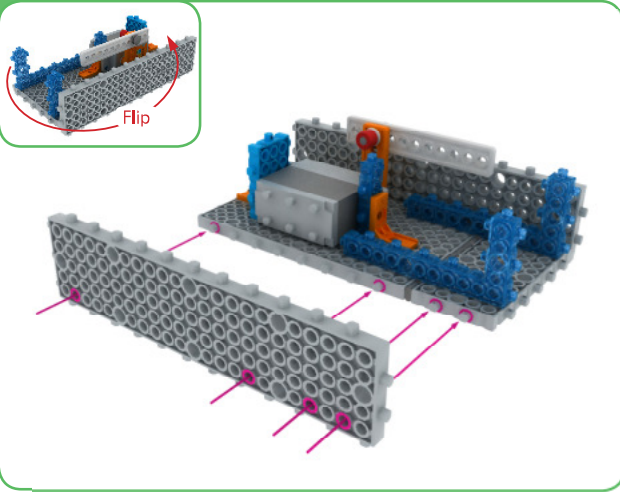
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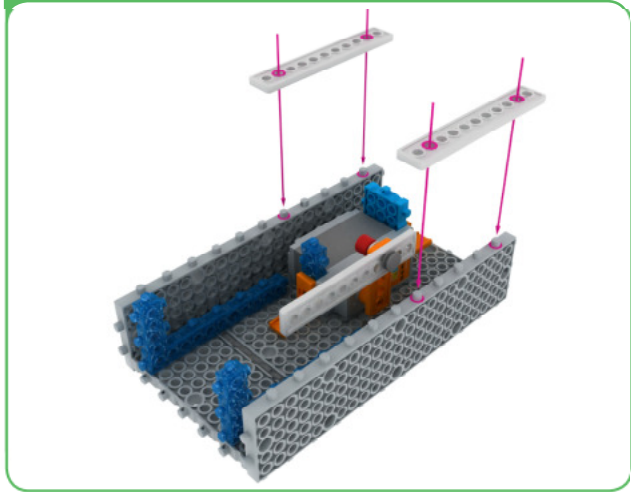
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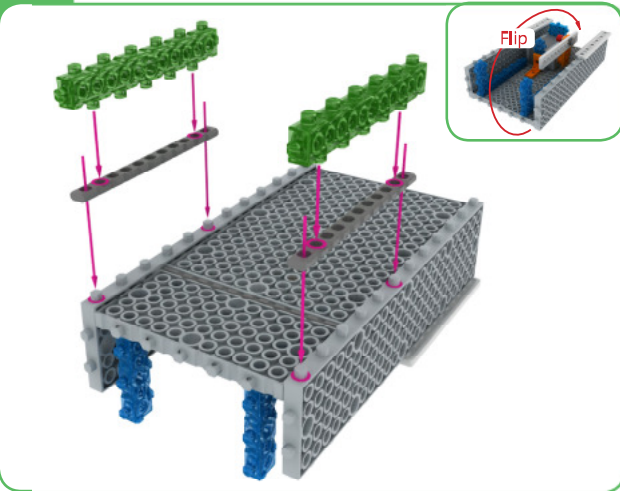
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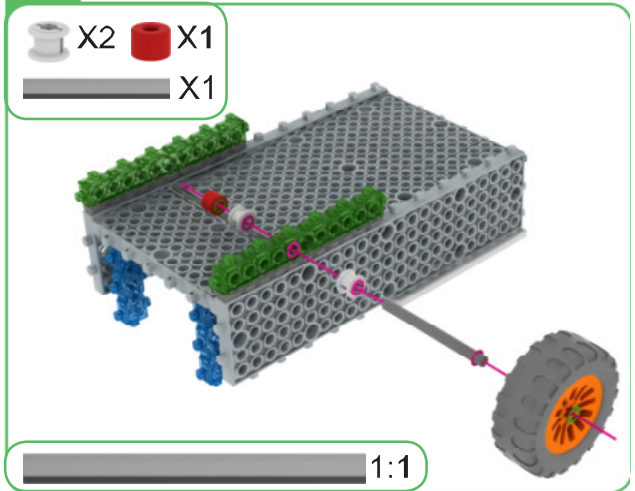
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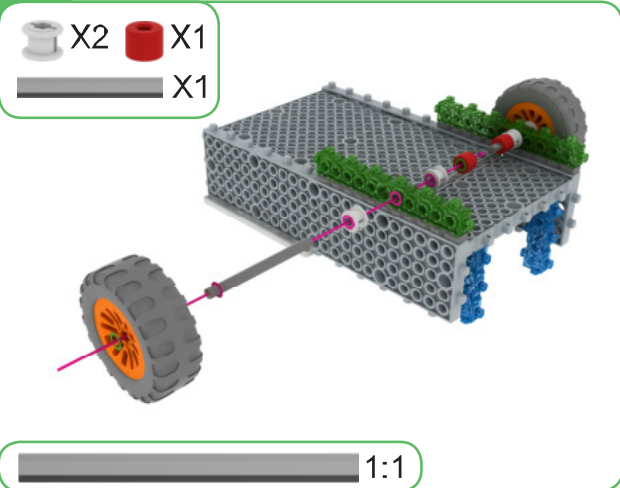
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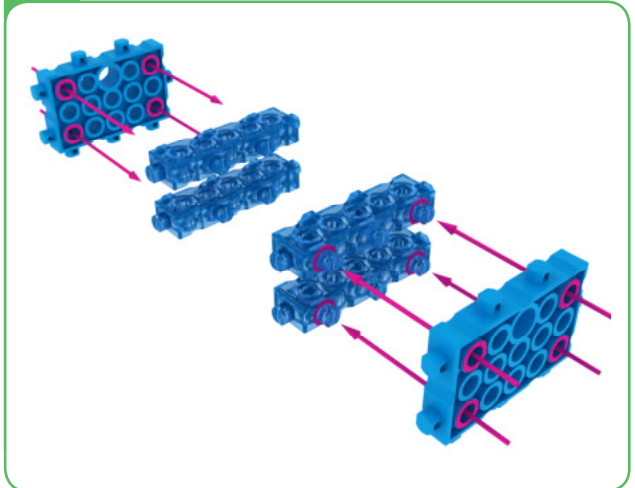
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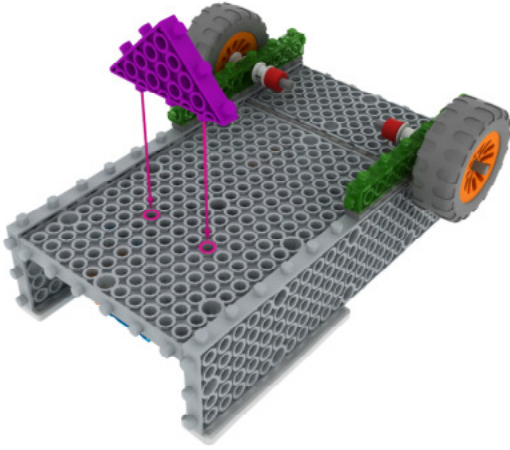
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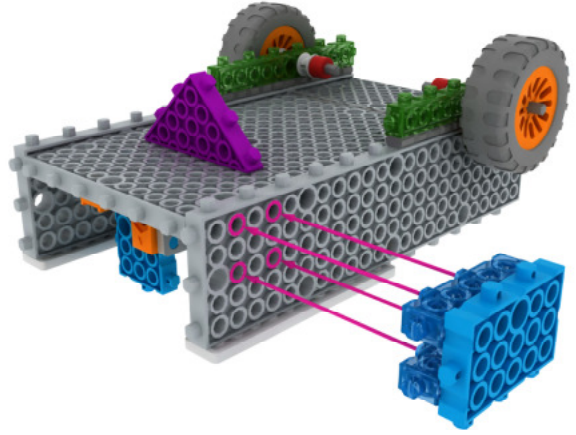
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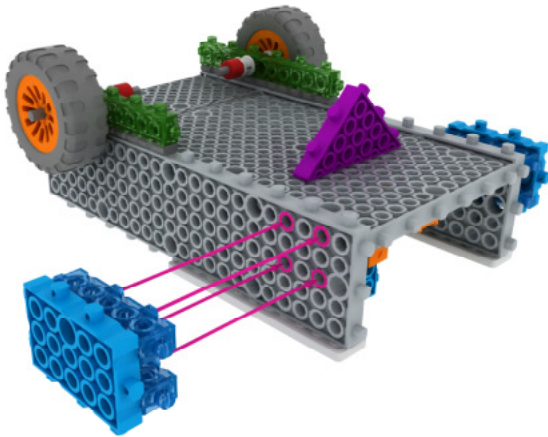
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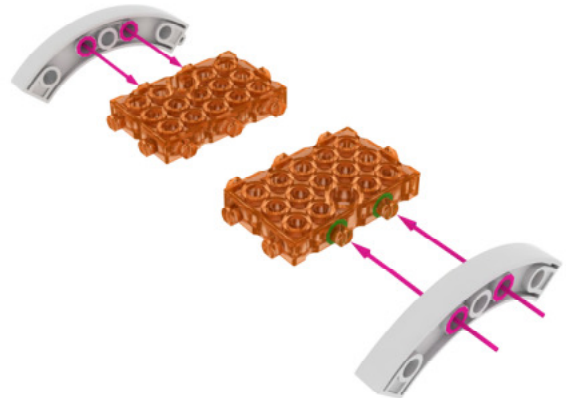
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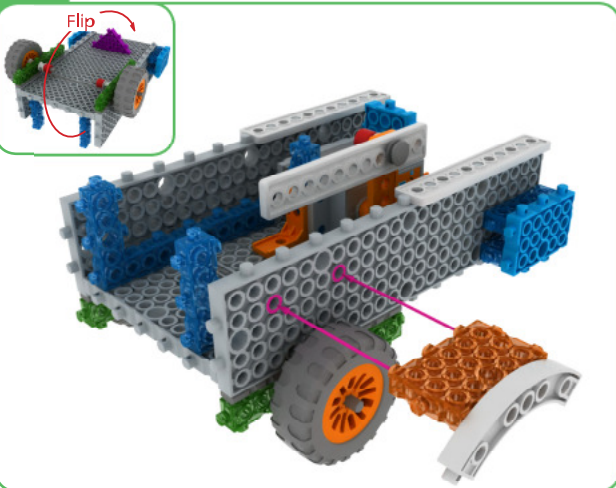
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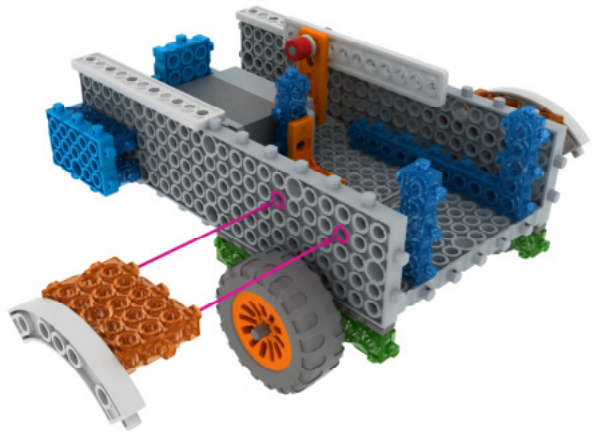
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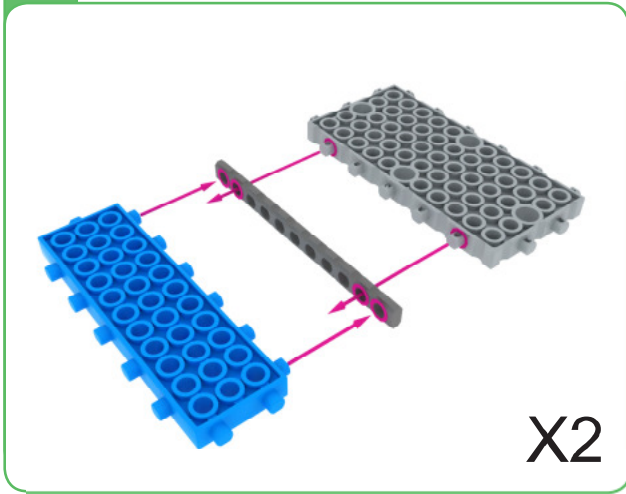
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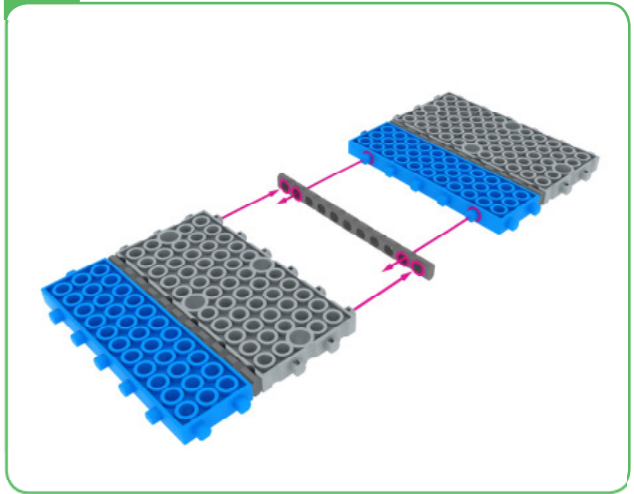
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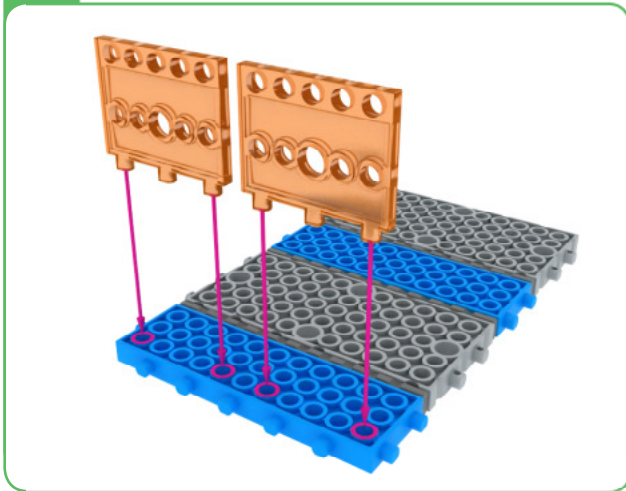
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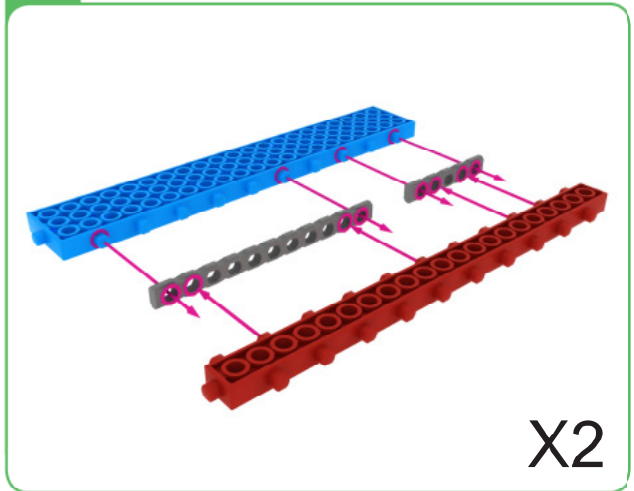
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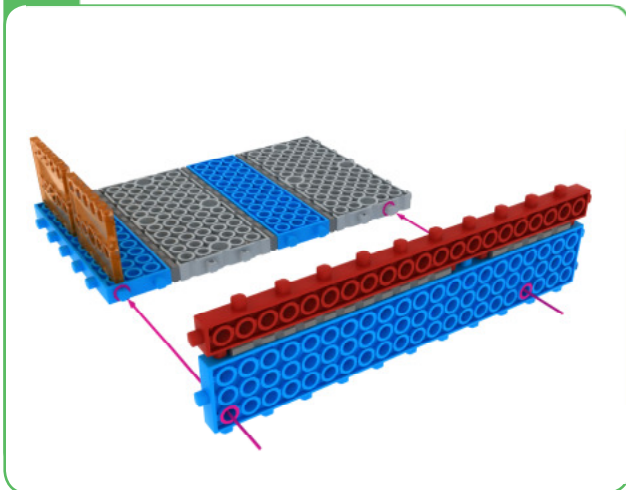
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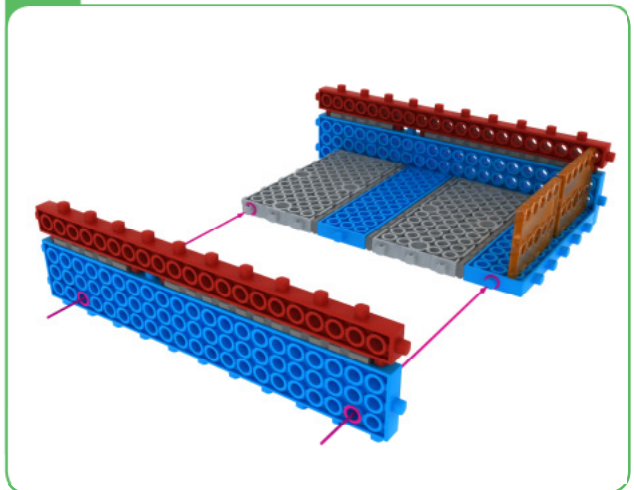
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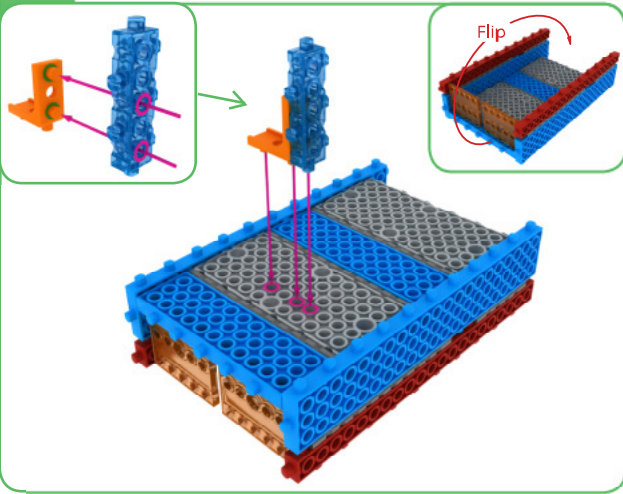
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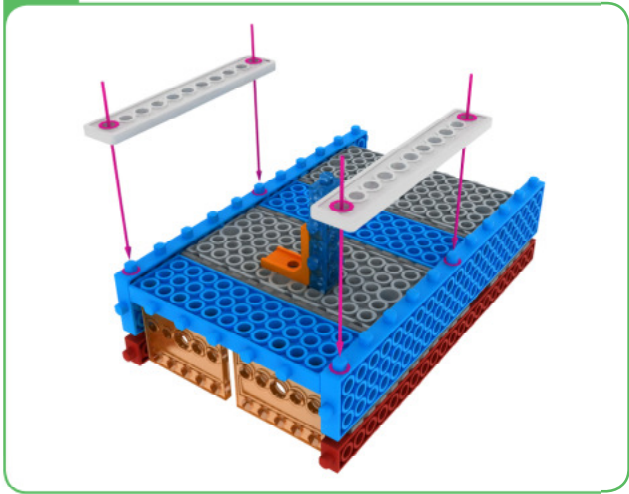
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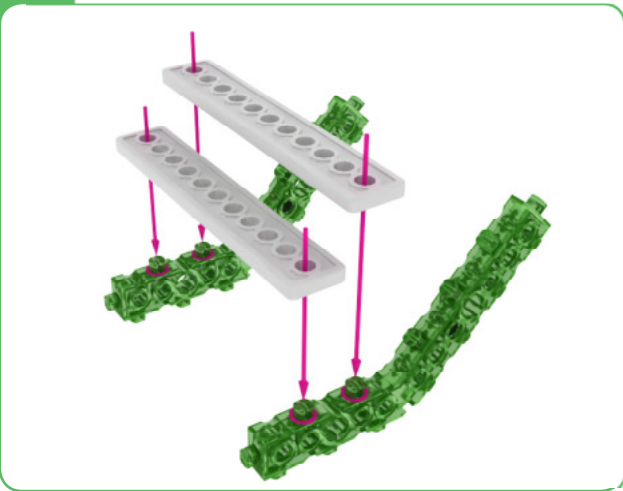
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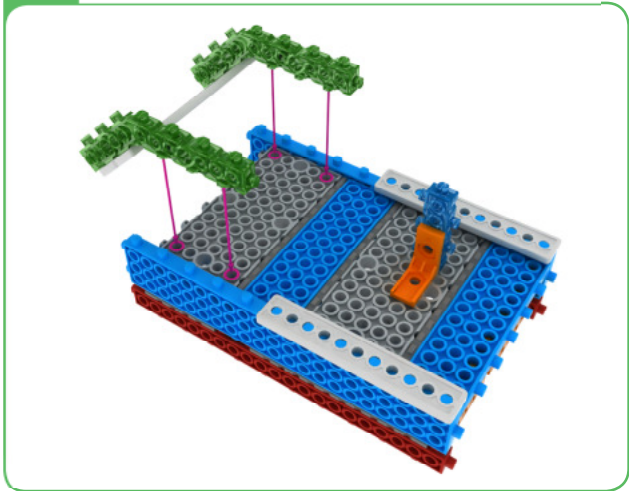
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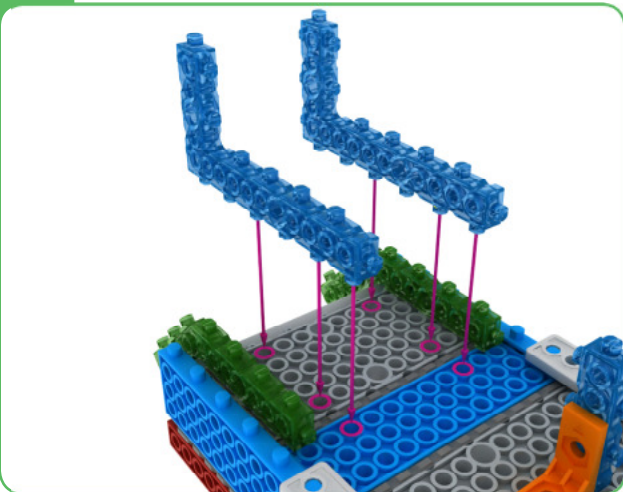
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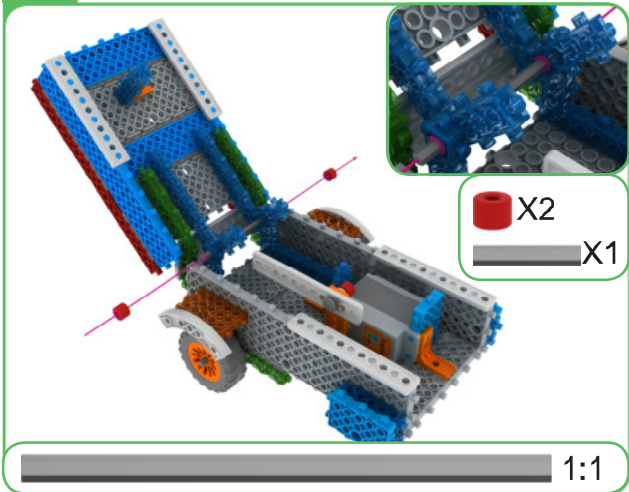
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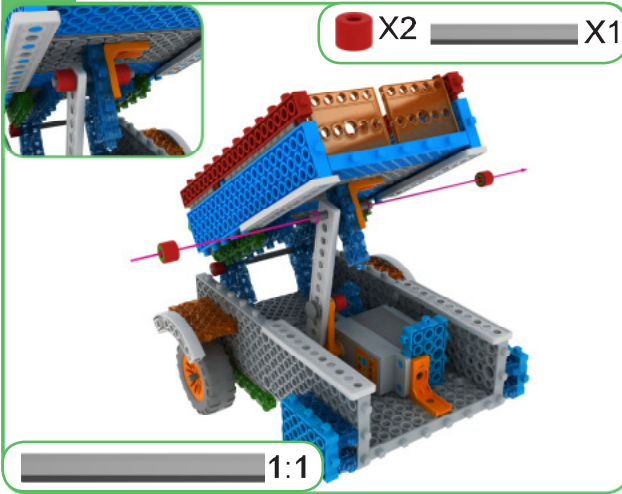


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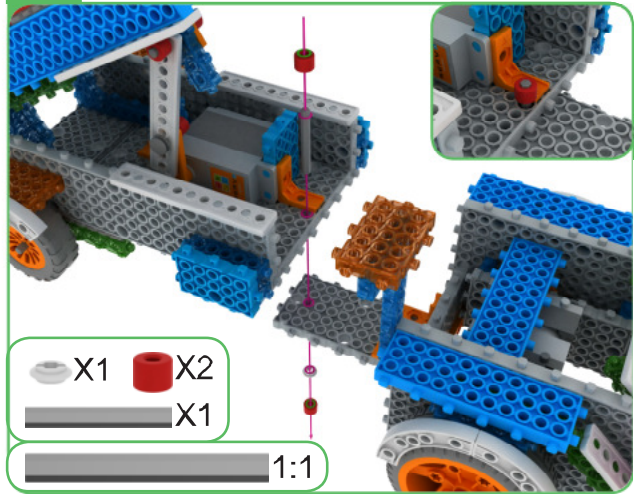


MY ROBOT TIME

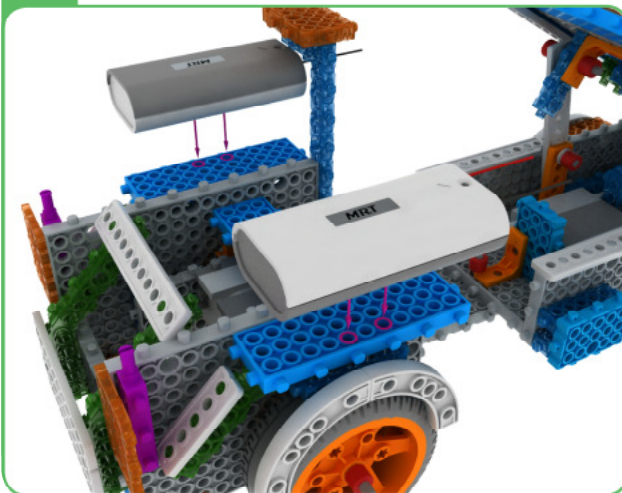
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63



64



65



66



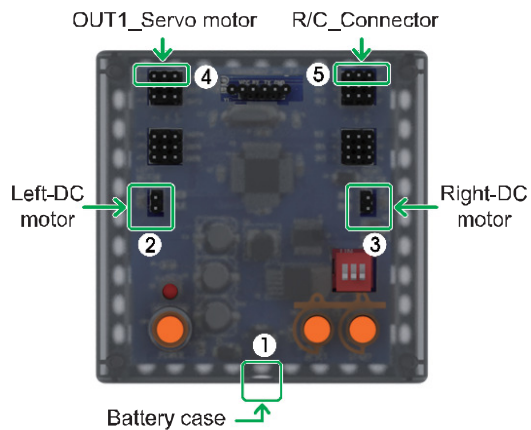
End





How to operate the Dump Truck

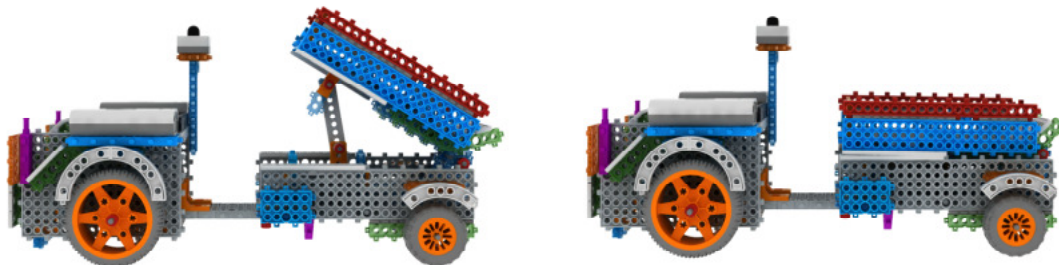
Connecting the main board



Connect in this order.

1. Connect Battery Cases to Power connector.
2. Connect Left-DC motor to Left-motor connector.
3. Connect Right-DC motor to Right-motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect RC receiver board to R/C connector.

Motion Pattern/Program

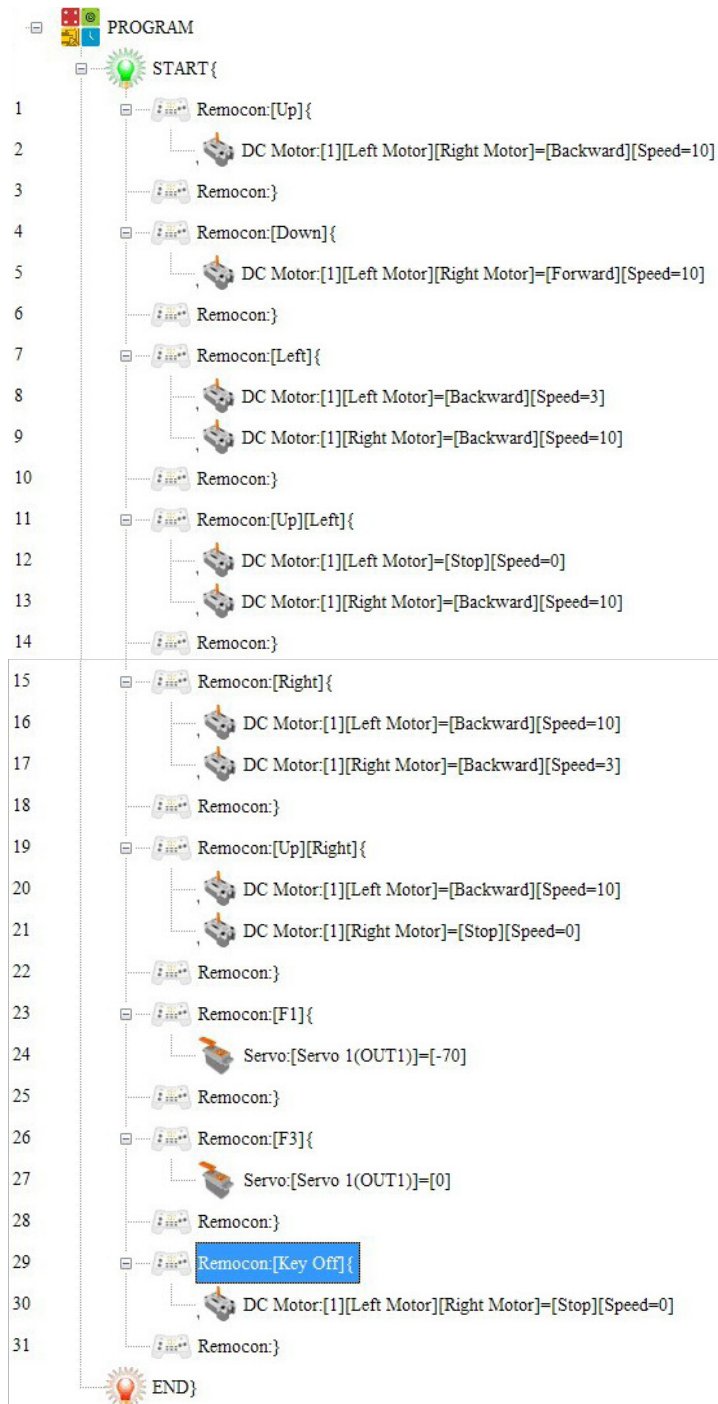


※ - Using the motion patterns as reference, let's write the program.

Program Download

1. Write the program.
2. Make sure Power / DC Motor connector and sensor's connector are well connected.
3. Check the power OFF state, then insert the download cable.
4. 'SAVE' and click the 'DOWNLOAD' button on the program window.
5. Turn on the power when 'DOWNLOAD' window opens. (Power ON)
6. Once the download is completed, remove the download cable and then turn the power off and on.
(Power OFF → Power ON)

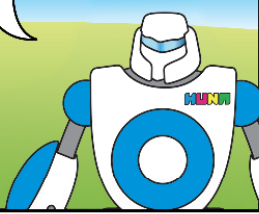

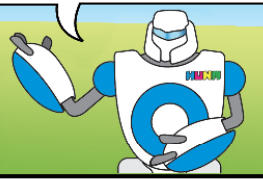
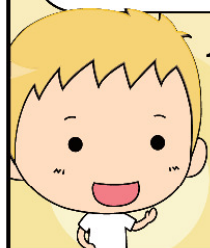

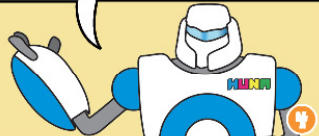
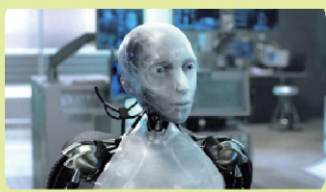
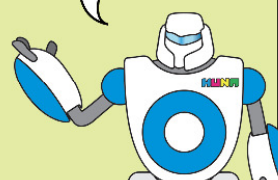

Program Example





Science

STEM 19. Where can we see potential energy?

<p>1 Harry, Do you know where we can find potential energy besides in water power?</p> 	<p>2 Well, I haven't thought about it yet.</p> <p>Have you heard of treadmills? Our ancestors used treadmills as a farming tool to grind various grains in the past?</p>  
<p>3 I know! I went to a museum and saw it. They also make use of potential energy.</p> <p>Right~</p> 	<p>4  Treadmill</p> <p>After pressing the tool with your feet, it will raise up to a higher position. Now, if you would remove your feet from the tool, it will have potential energy because it's falling down from a higher position.</p> <p>Does water mills work in the same manner?</p> 
<p>5  Water mill also works by using the power of water, it grinds grains in the same way as treadmill.</p> 	<p>6 Wow! Our ancestors were really wise!</p> 



Let's have a look and see what things we can find that uses potential energy?

Spiral notebook graphic with a blank writing area.

MRT3-3

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Web ◆ www.myrobottime.com

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