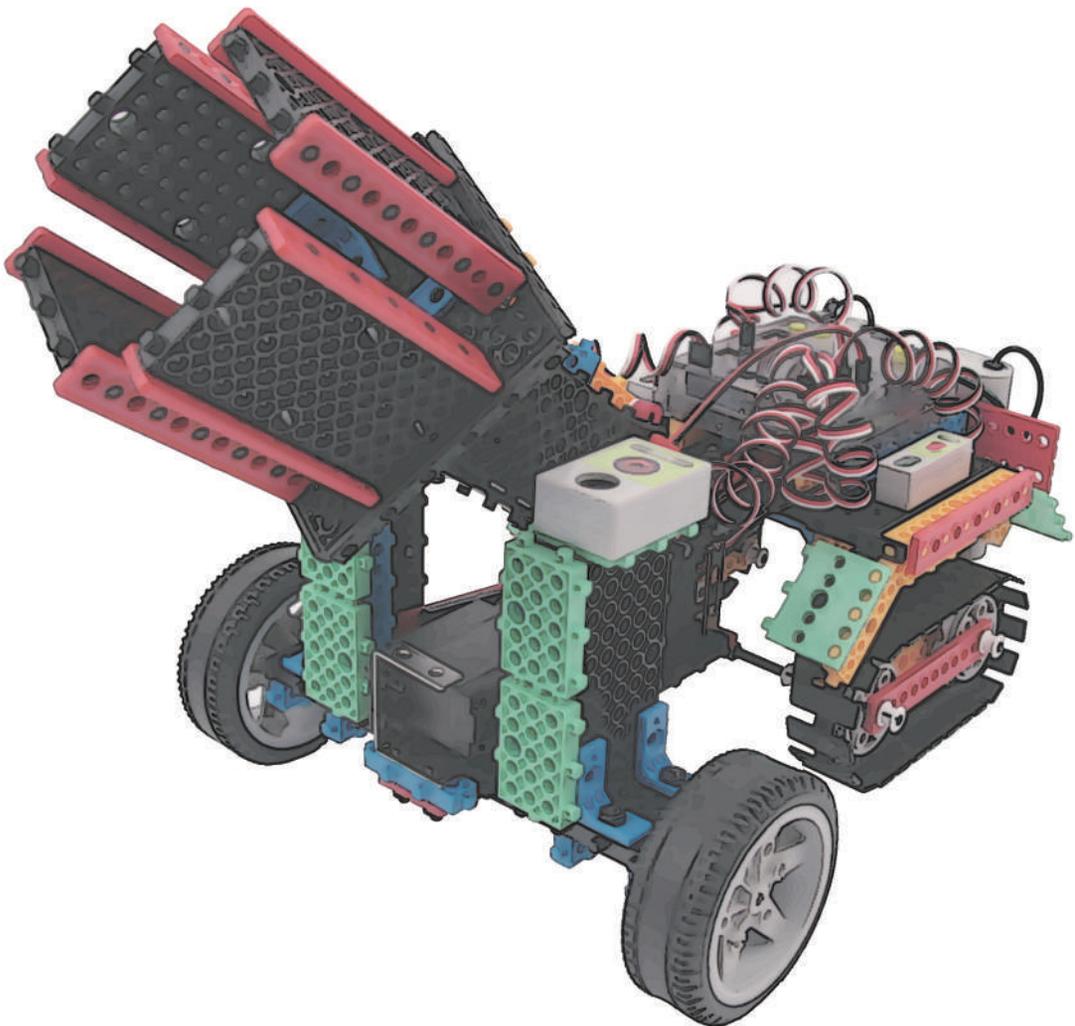


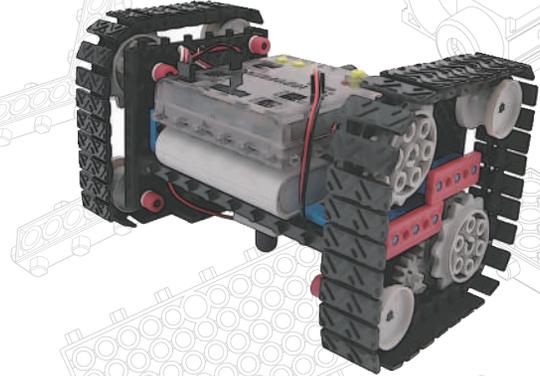
# HUNAROBO

Advanced Course VOL.1



# HUNAROBO SCIENCE CLASS ADVANCED COURSE

## CONTENTS



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All about electronics! what is electronics exactly? .....	6

### What we are going to learn? (Robot Story)

• You can't move anything without me - Gear .....	8
• Let's move objects! - Conveyer .....	24
• It is so flashy! - Light Energy .....	37
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• My God! Hot! thermal energy - Thermal Energy .....	53
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### Let's Make it!

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## HUNAROBO 3 Education Program

### Educational Development Program

- ▣ - The whole programs focus on the development of scientific, robotic and other technological skills.
- Development of basic scientific knowledge and creative thinking skills, to solve complex problems and program development to raise problem solution-oriented abilities and to create novel solutions.

### Training Features

- ▣ - Challenges and promotes problem-solving skills and improve concentration.
- Improve leadership and communication skills through small group activities.
- Education linked to kindergarten and elementary school science curriculum
- Under the guidance of a teacher, the goal will be achieved through self-assembly to promote a good learning environment.

### HUNAROBO 3 (Advanced Course)

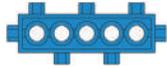
In this advanced Course for HUNAROBO 3, we will learn the following;

Division	The objects of study/Theme	The contents of study/Activities
1 Power	Gear	Understanding the principle of gears and making a racing motor bike (MOTOR BIKE) : [remote control/game]
	What's conveyor?	Making a robot that moves along with caterpillar tracks (HUNA-E 2) : [IR sensor/Mic sensor]
	Light Energy	Making a light sensing robot (HOT-DOG) : [CdS/ IR sensor]
	Cam	Making my own robot that uses the principle of cams [Creative assembly]
2 Energy 2	Thermal Energy	Making a robot that can move in any dimension using caterpillar tracks (OFF-ROADER) : [remote control]
	Use of thermal energy	Understanding heat(thermal) energy and making your own robot [Creative assembly]
	Electric Energy	Making a robot you can play dice with (DICE-BOT) : [remote control/Buzzer sensor/game]
	Servo motor and AI 1 (Artificial Intelligence)	Making a four -wheel motor bike that uses servo motors and DC motors (Four-wheel Motor bike(ATV) ) : [remote control/LED sensor]
3 High-tech Robot	Link	Making a racing car that uses the principle of links (FORMULA CAR) : [remote control/LED sensor]
	Link2	Understanding link ,servo motors and making your own robot [Creative assembly]
	AI 2(Artificial Intelligence)	Making a robot that can make directional changes by itself using two servo motors (PTEROSAURS) : [remote control]
	Ethics of robot	Making a robot that uses two DC motors and two servo motors (DUKE TANK) : [remote control]

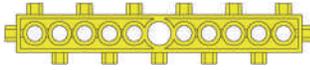
## List of the parts

### Block

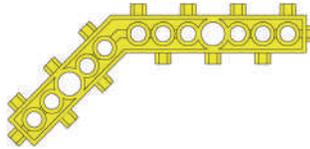
The form and color of some parts may be different when compared to actual parts due to continues improvement of production quality.



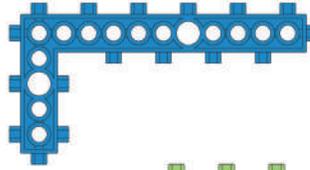
Block15 (10)



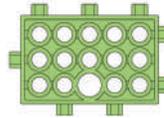
Block111 (6)



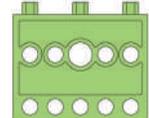
Block135 (6)



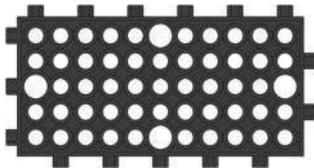
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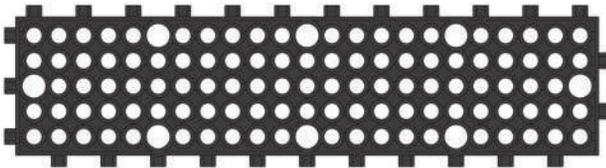
Block35 (6)



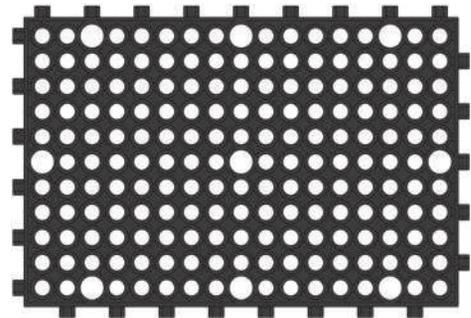
Motor Mount (4)



Block511 (6)



Block523 (2)



Block1117 (2)

### Frame / Adapter



frame5 (10)



frame11 (10)



frame21 (4)



adapter1 (10)



adapter2 (10)



L Adapter (8)

### Shaft / Bush / Bolt



Connection Shaft (4)



Shaft(S) (4)



Shaft(M) (4)



Shaft(L) (4)



Bolt(S) (20)



Bolt(M) (10)



Bolt(L) (10)



Coupling (4)



Nut (40)



Red Bush (10)



Half Bush (20)

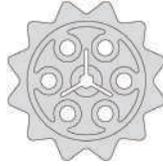


Bush (20)

## Wheel/ Gear



Wheel(L) (2)



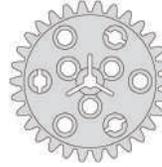
Sprocket (2)



Guide Wheel (2)



Caterpillar Track (80)



Gear(L) (2)



Gear(M) (2)



Gear(S) (2)

## Electronic Part



Buzzer Board (1)



Mic Sensor (1)



LED Board (2)



Download Board (1)



4P Download Cable (1)



USB Cable (1)



Servo Motor( 1)



Servo Horn( 1)



Servo Bracket( 2)



6V Battery Case (1)

## Electronic parts

### LED Board



**1. Emitting part (LED)**

Displays received signals from the mainboard with light.

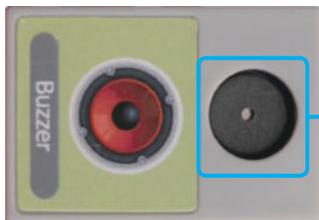
### Mic Sensor



**Mic Sensor**

Detects sounds from outside and converts them into electrical signals.

### BUZZER



**Buzzer Board**

Displays received signals from the mainboard with sound.  
(Please remove seal when using!)

### USB Download

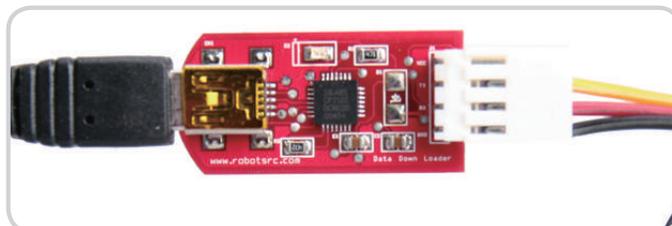


**Download cable connection**

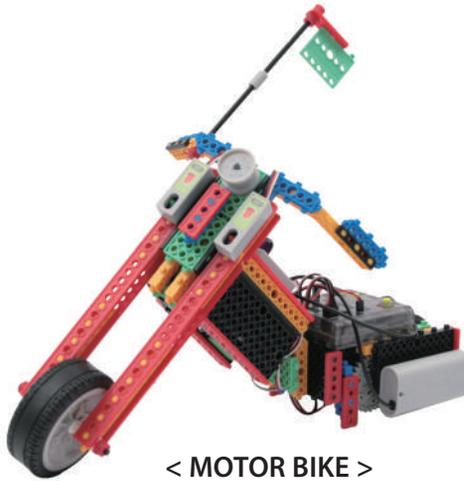
Connection of the mainboard and the USB Download connector

**USB Cable Connector**

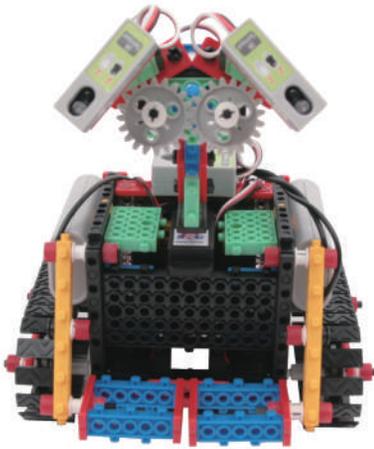
PC and USB Download Connector exchange signals.



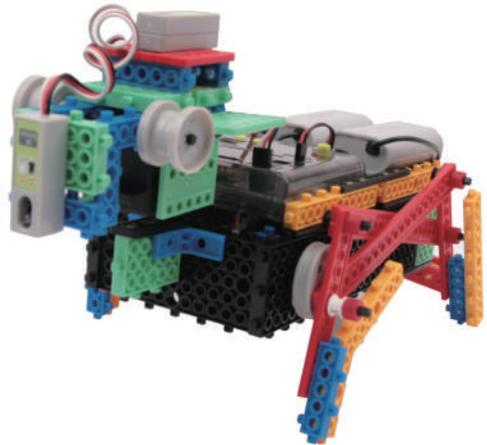
## What robots are we going to assemble? ↔



< MOTOR BIKE >



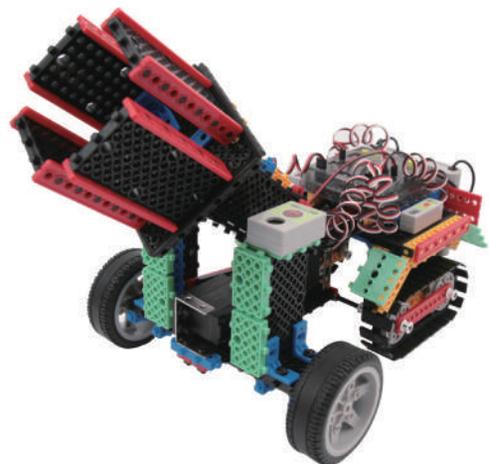
< HUNA - E2 >



< HOT - DOG >



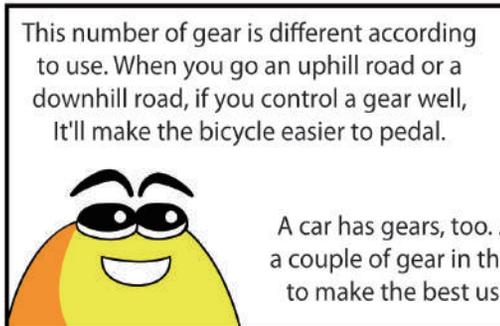
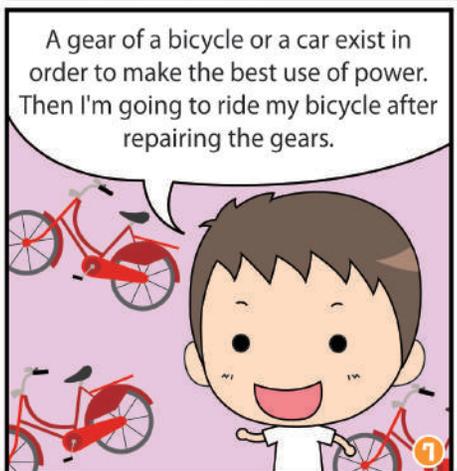
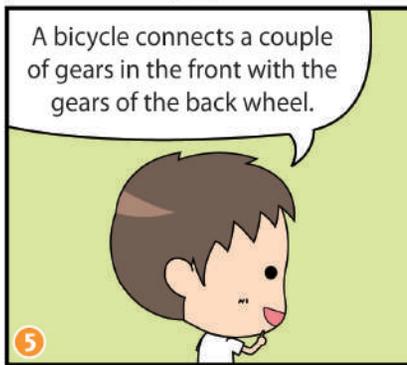
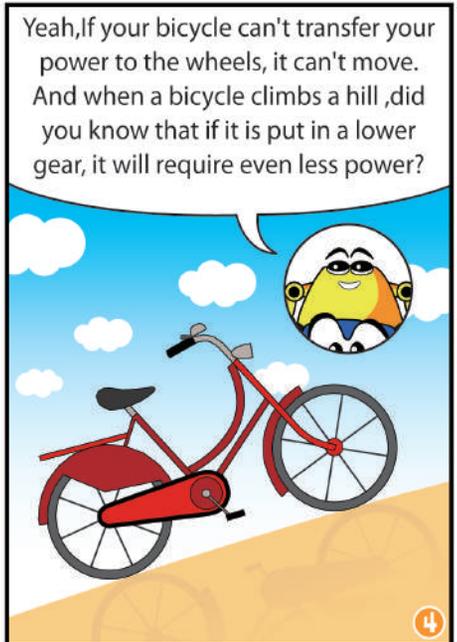
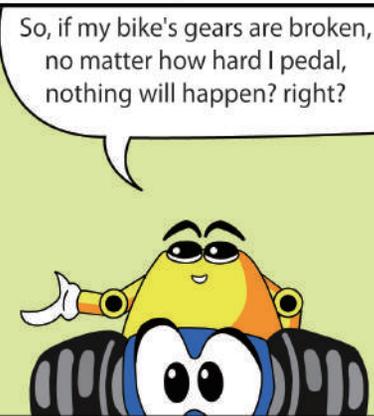
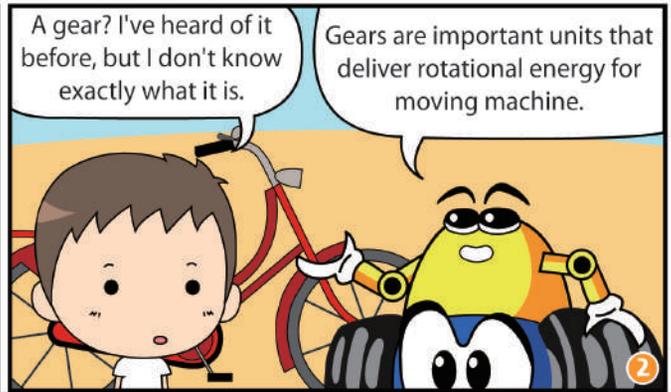
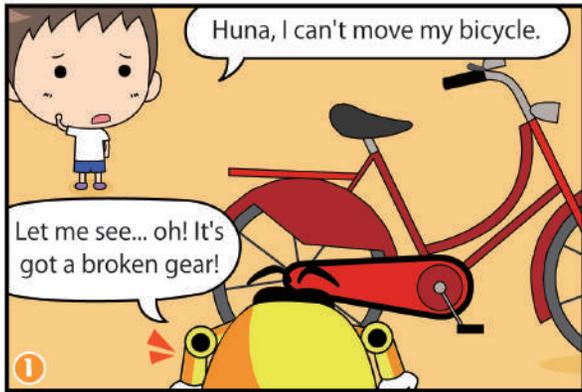
< OFF - ROADER >



< DICE - BOT >



You can't move anything without me! - Gear



A car has gears, too. A car is equipped with a couple of gear in the transmission in order to make the best use of rotational power.



## How to make a robot that change it's direction using a servo motor



### MOTOR BIKE



This motor bike imitates on of the famous motorcycles , the Harley Davidson. It is controlled using a remote control. Let us create a motor bike that can keep it's balance using two wheels.

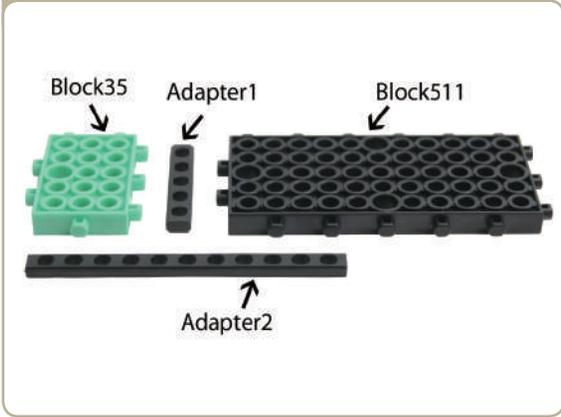
After assembling, one can play the Boxing Game with friends.



### Prepare parts for assembly

	Block511	×8		Frame21	×2	
	Block90	×2		Frame11	×2	
	Block135	×4		Frame5	×13	
	Block111	×7		Adapter1	×4	
	Block15	×8		Adapter2	×8	
	Block35	×8		Connection Shaft	×3	
	Motor Mount	×1		Shaft(S)	×1	
	Guide Wheel	×1		Shaft(M)	×1	
	Wheel(L)	×2		Shaft(L)	×3	
	DC Motor	×2		L Adapter	×4	
	Servo Motor	×1		Half Bush	×11	
				Bush	×4	
				Red Bush	×6	
				Coupling	×1	
				Gear(M)	×4	
				Gear(L)	×2	
				Bolt(S) / Nut	×4	

1

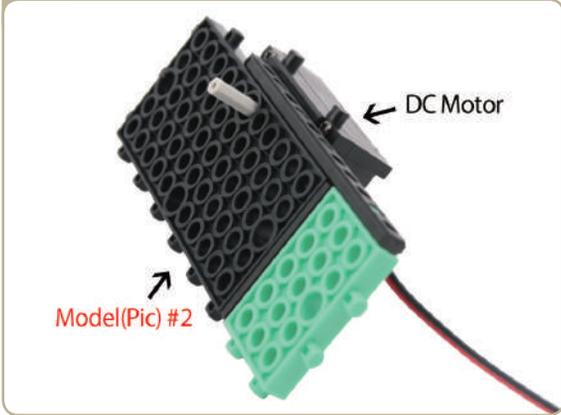


2

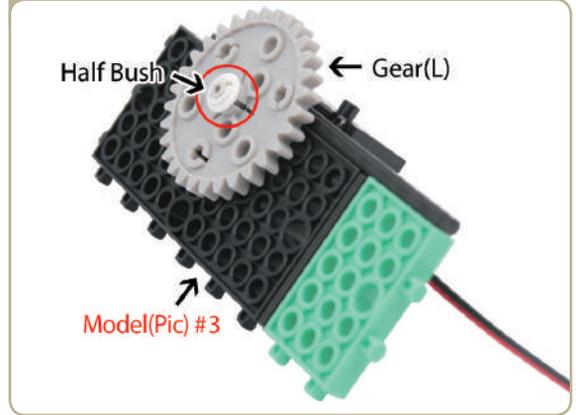


Assemble two identical models.

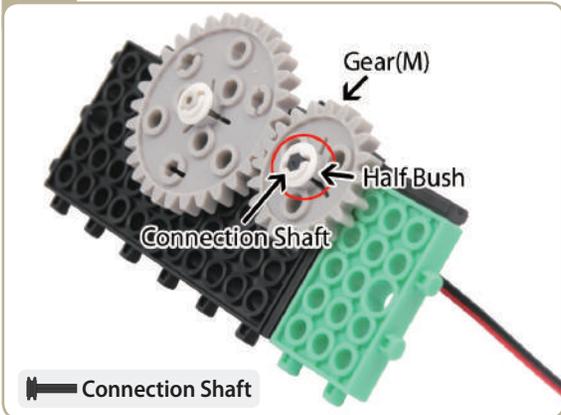
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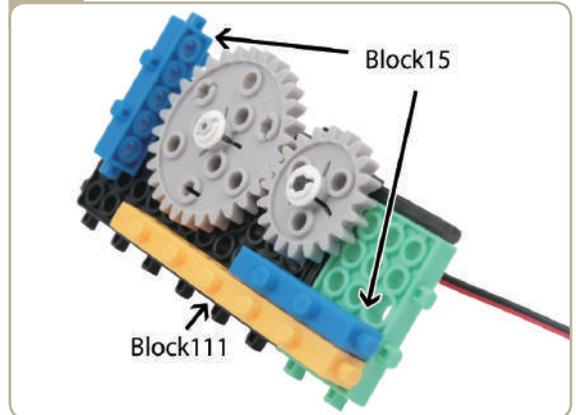
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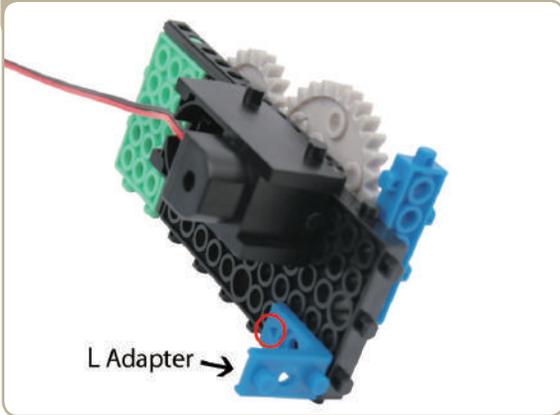
5



6

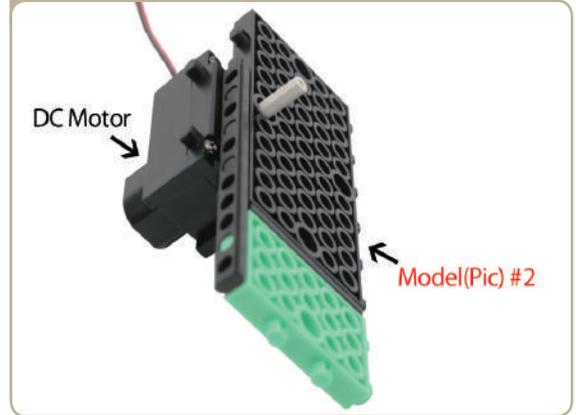


7 ( Back of model(Pic)#6 )



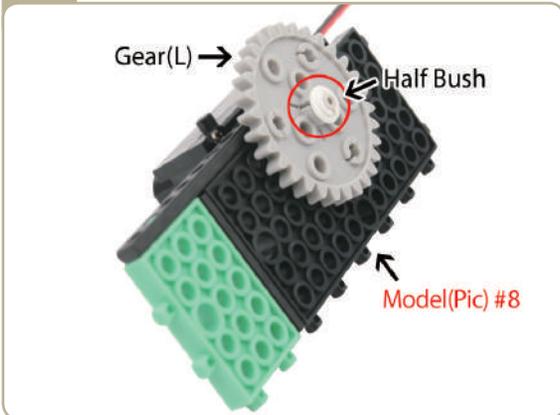
Attach a 'L' adapter to the back side of the model(pic)#6. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

8

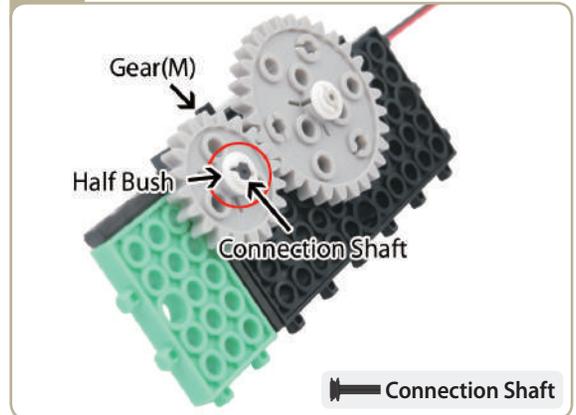


Connect a previously constructed part of model(pic)#2 to DC motor.

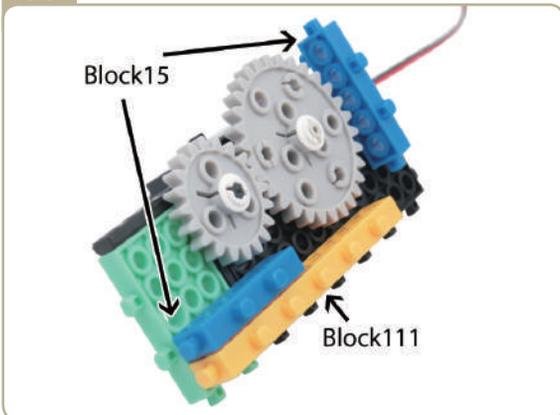
9



10



11



12 ( Back of model(Pic)#11 )



Attach a 'L' adapter to the back side of the model(pic)#11. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)



2. What is the name of the part that transmits power and rotation between two shafts?

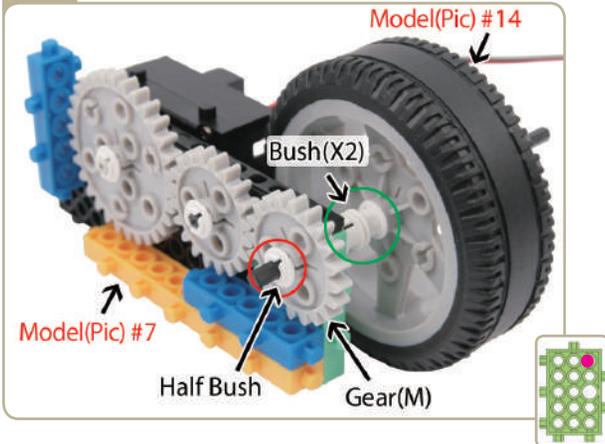
13



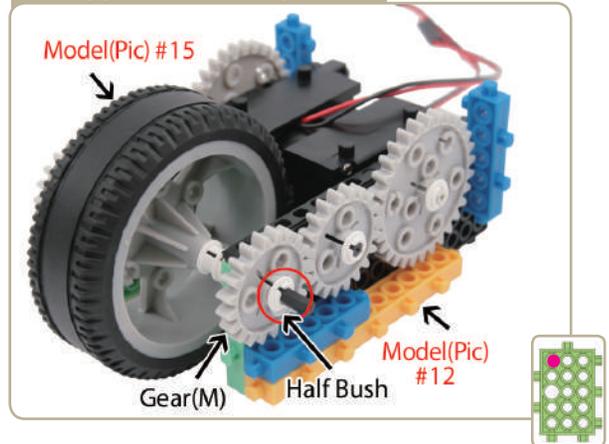
14 ( Opposite of model(pic)#13 )



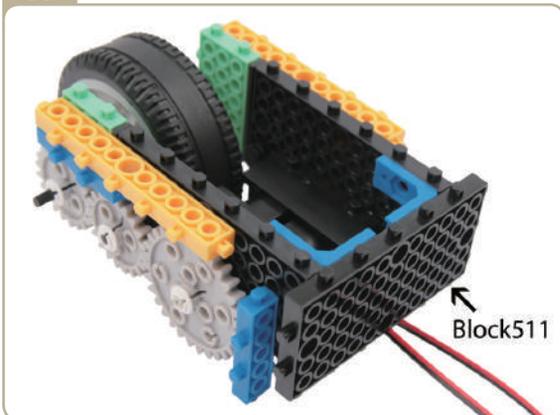
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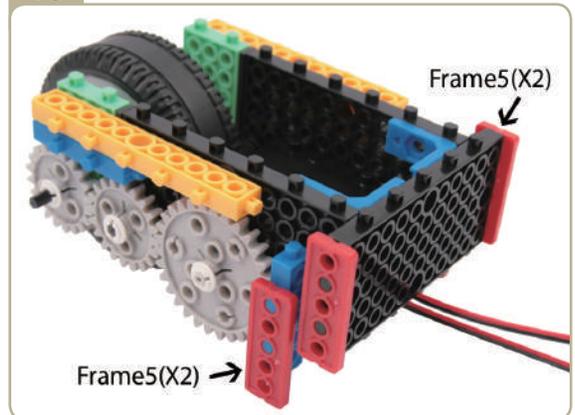
16 ( Opposite of model(pic)#15 )



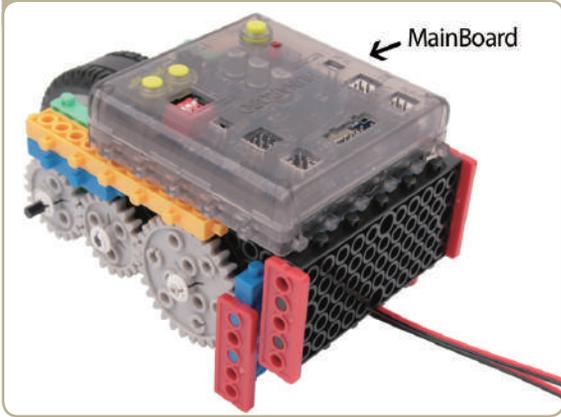
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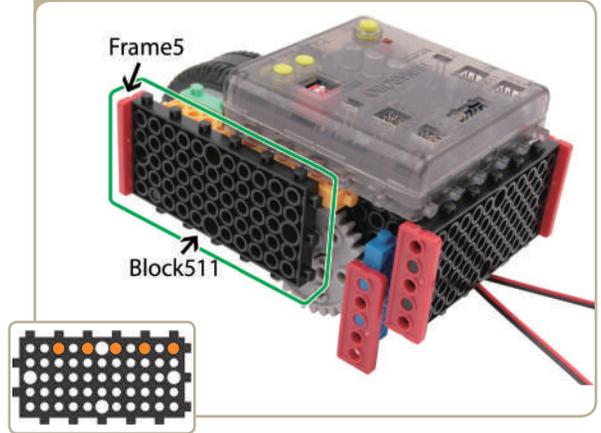
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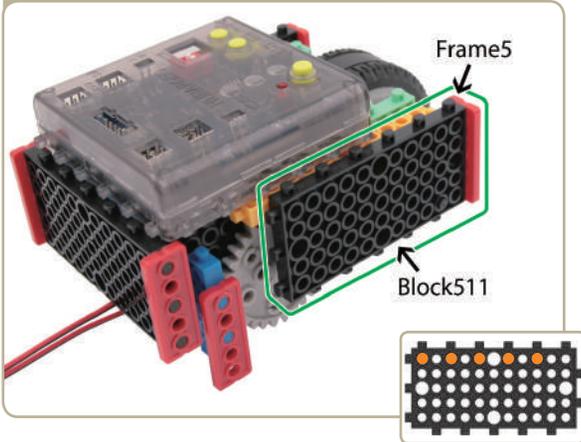
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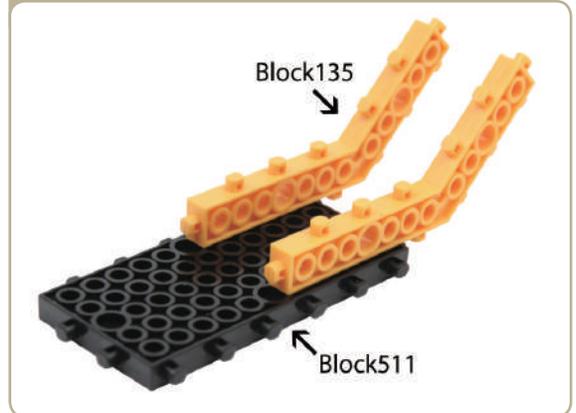
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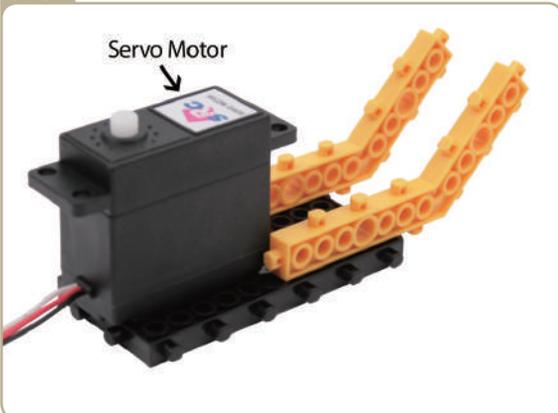
21 ( Opposite of model(pic)#20 )



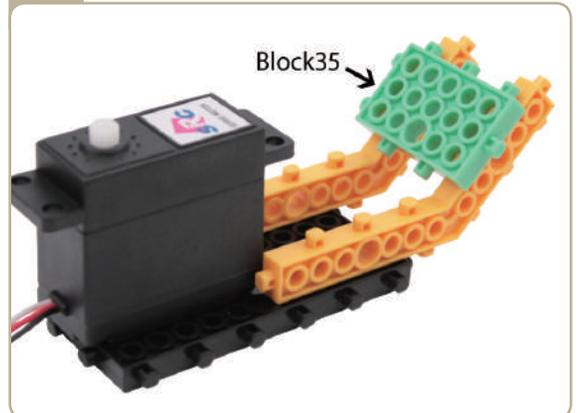
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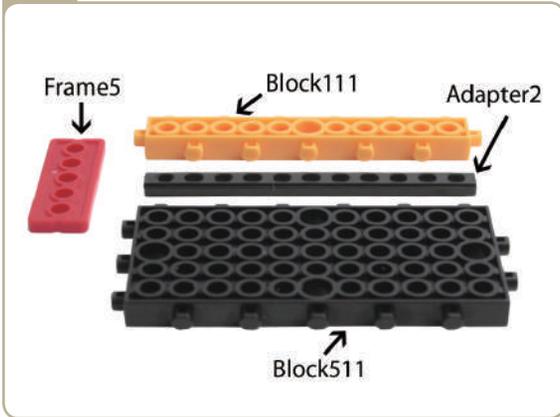
23



24



25



26



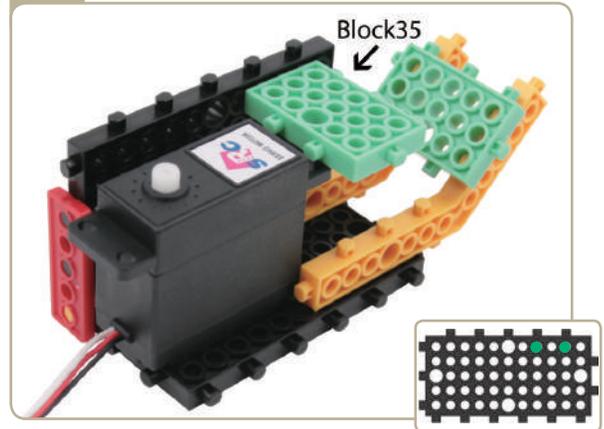
Assemble two identical models.

27

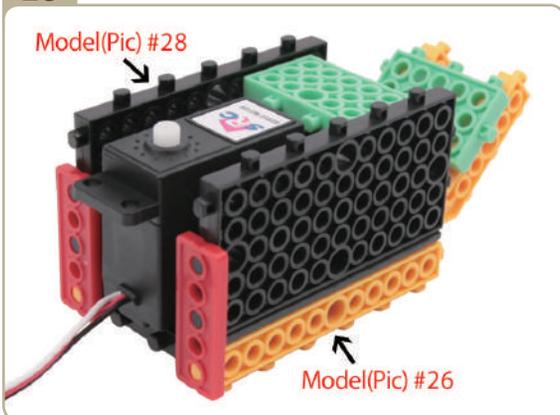


Connect a previously constructed part of model(pic)#26 to model(pic)#24.

28

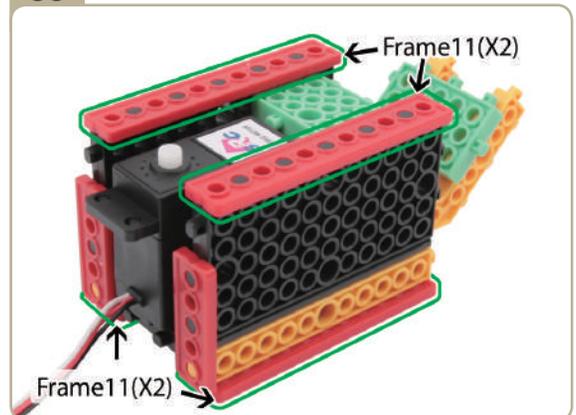


29



Connect a previously constructed part of model(pic)#26 to model(pic)#28.

30



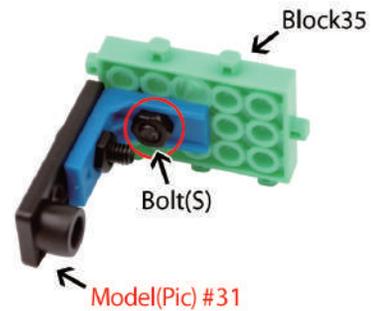
Attach four 「frame11」s to model(pic)#29 as illustrated in the picture.

31

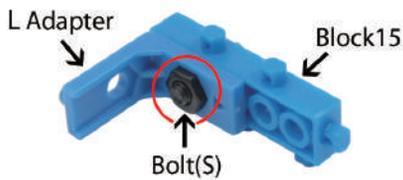


Connect a 'L' adapter to servo horn.  
(Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

32

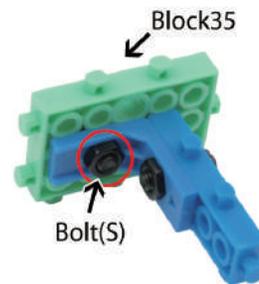


33

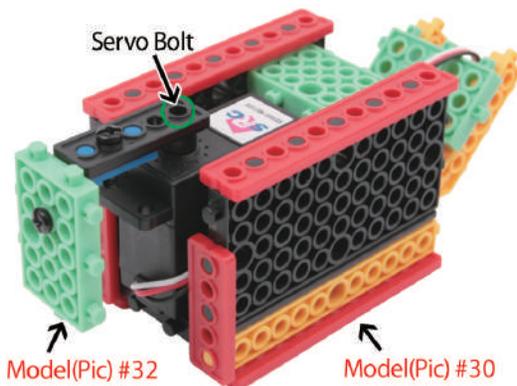


Connect a 'L' adapter to 'block15,' with a small bolt.  
(Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

34

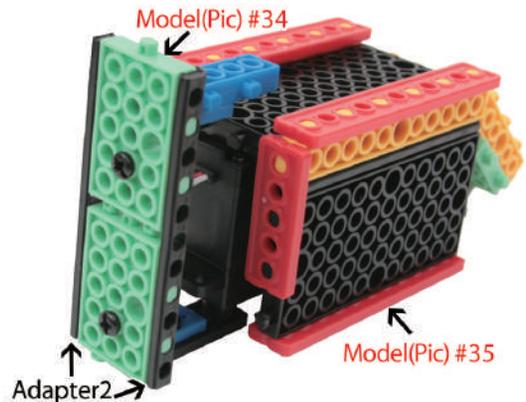


35



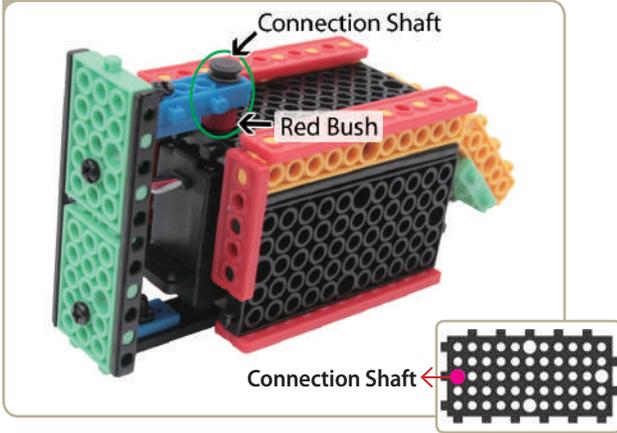
After adjusting zero point of servo motor, fix model(pic)#32 to model(pic)#32 with a small servo bolt.

36

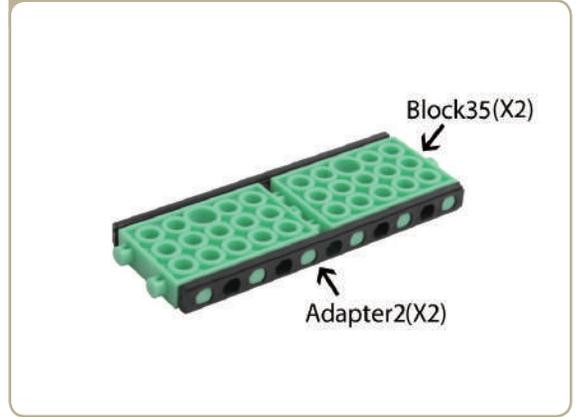


Turn model(pic)#35 upside down, then combine model(pic)#34 with two 'adapter2's.

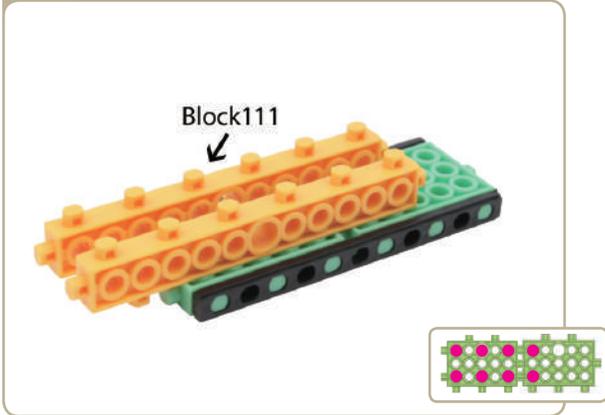
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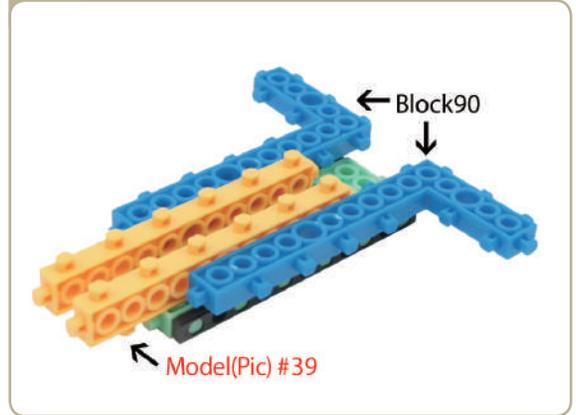
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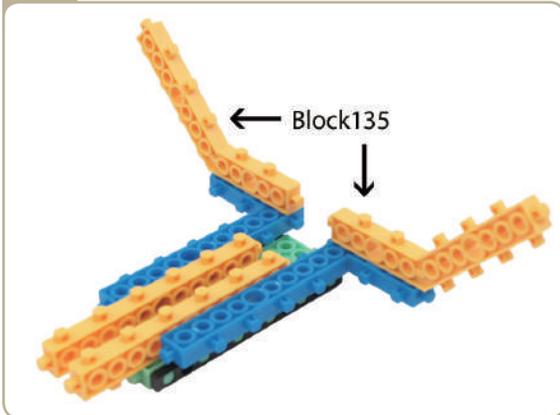
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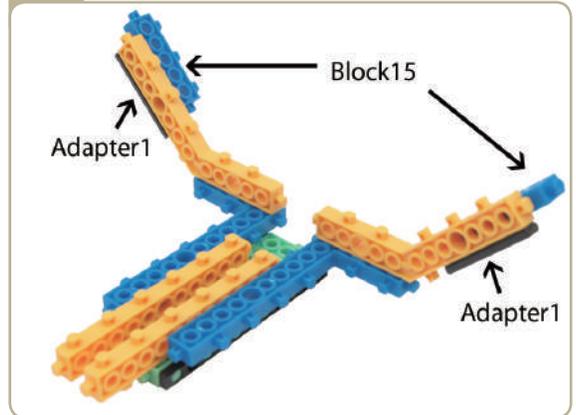
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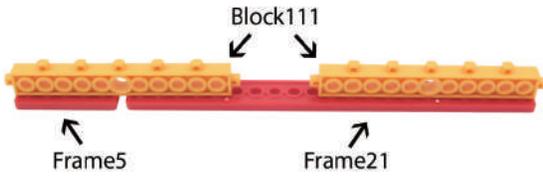
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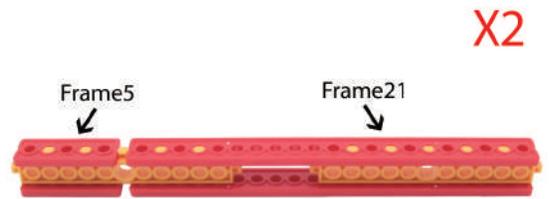
42



43



44



Assemble two identical models.

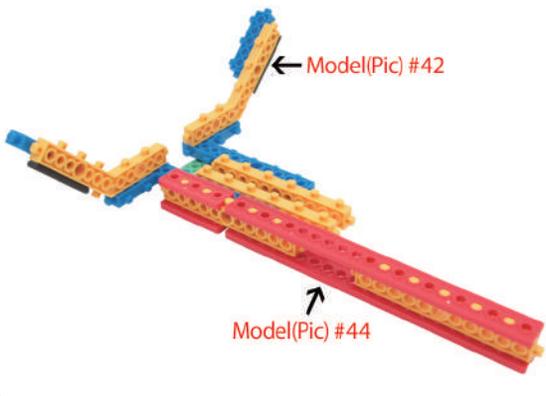
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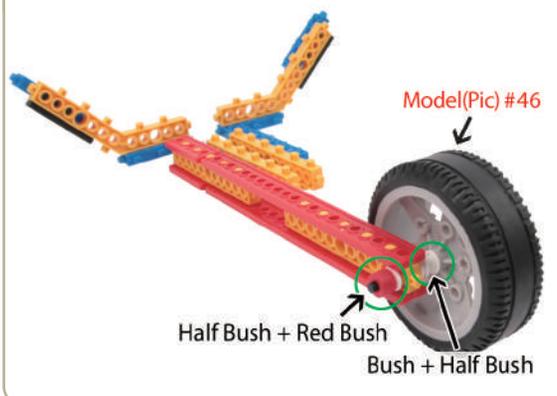
46 ( Opposite of model(pic)#45 )



47



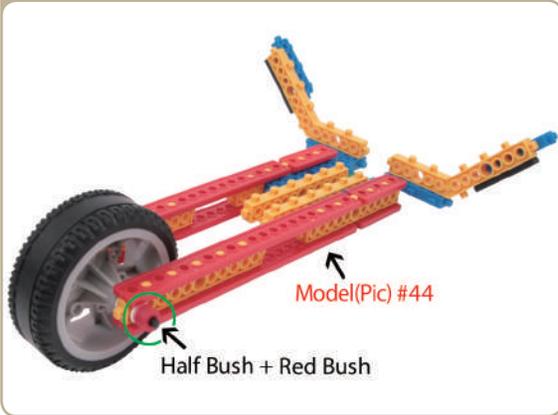
48



Connect a previously constructed part of model(pic)#44 to model(pic)#42.

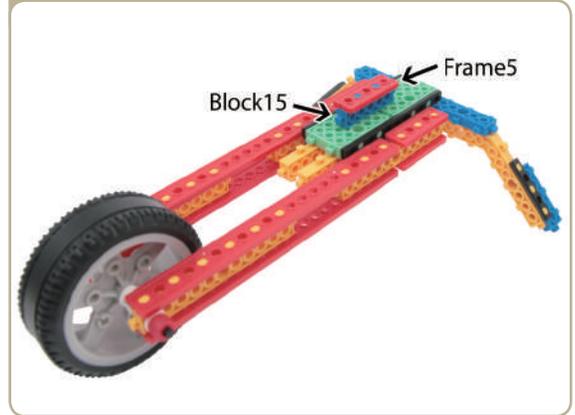
**Q** 5. What is the mechanism that carries objects using a chain?

49



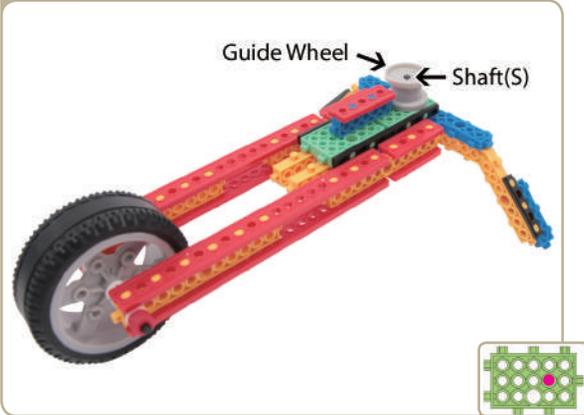
Connect a previously constructed part of model(pic)#44 to model(pic)#48.

50

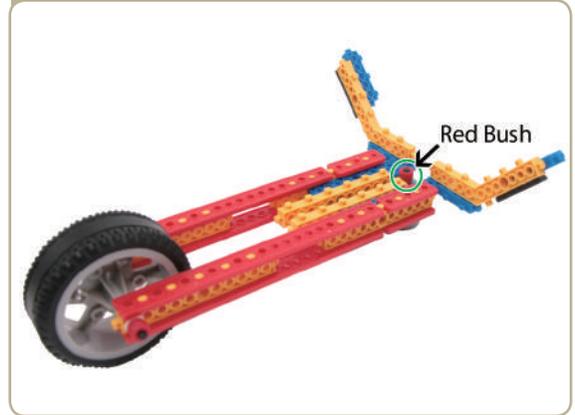


Turn model(pic)#49 upside down, then attach a 'block15' and a 'frame5' to it.

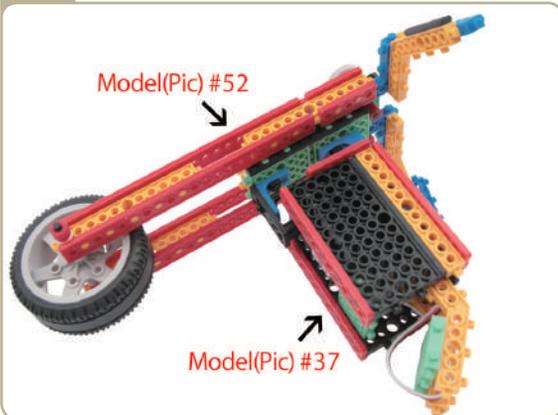
51



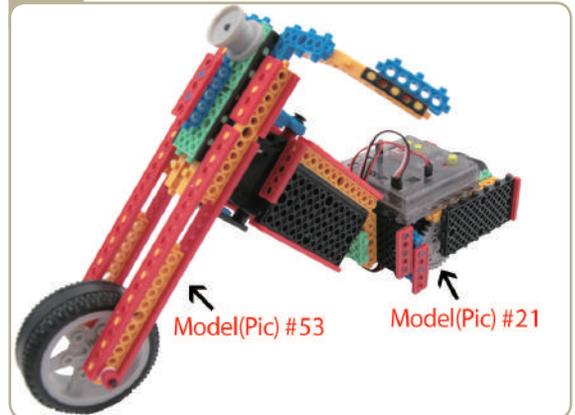
52 ( Bottom of model(Pic)#51 )



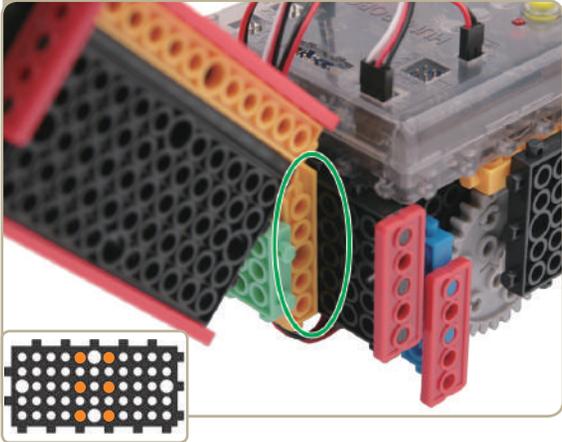
53



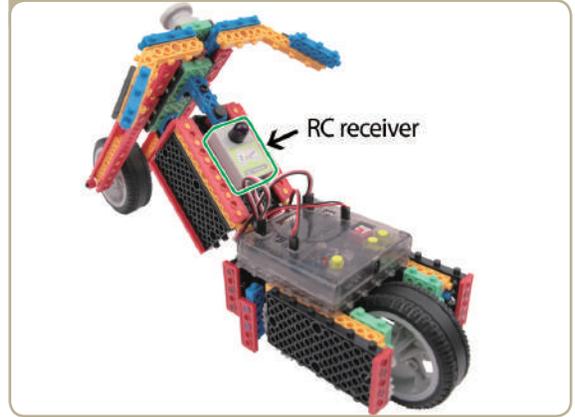
54



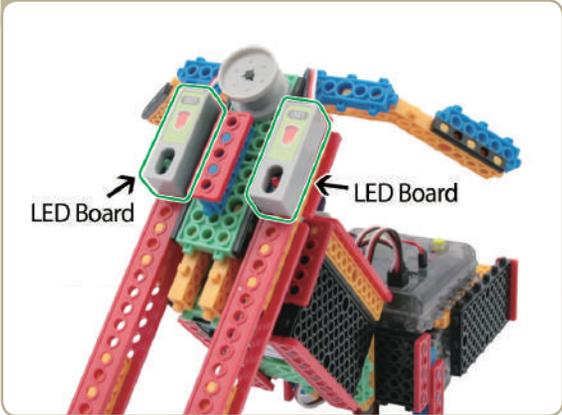
52 (Enlargement of model(Pic)#51)



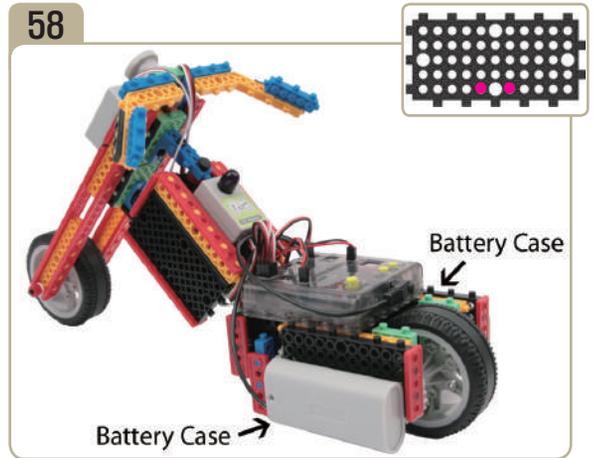
56



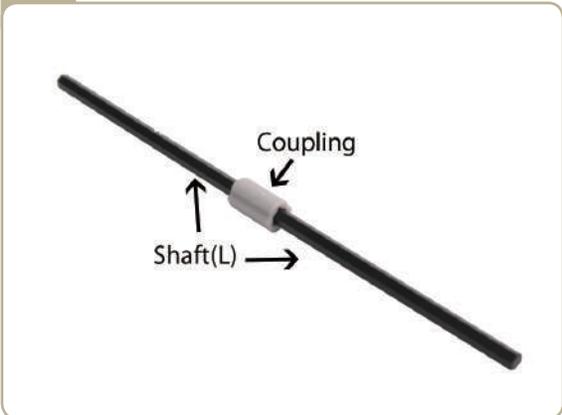
57



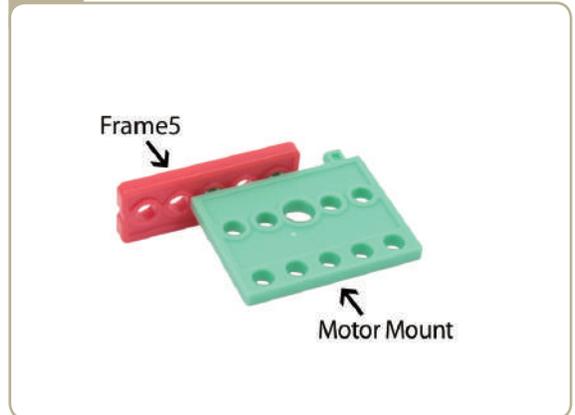
58



59

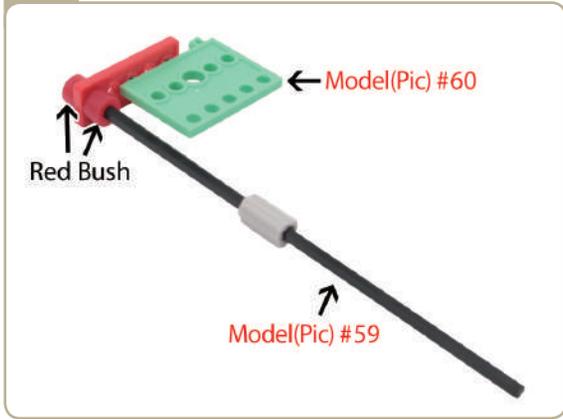


60

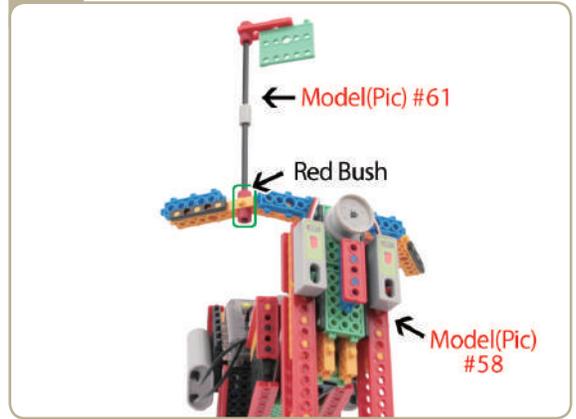


Q 6. What is the name of device that carries objects continuously while turning it on a belt that hangs between the two wheels?

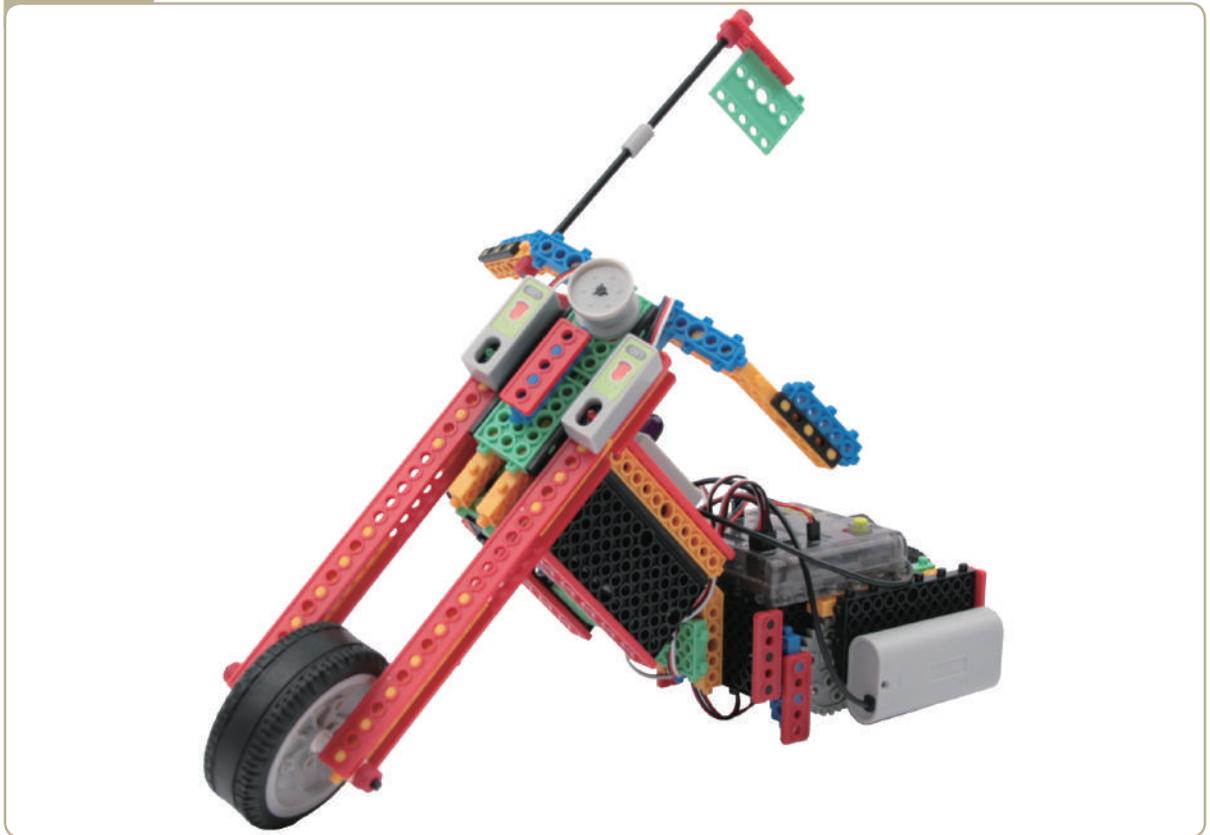
61



62



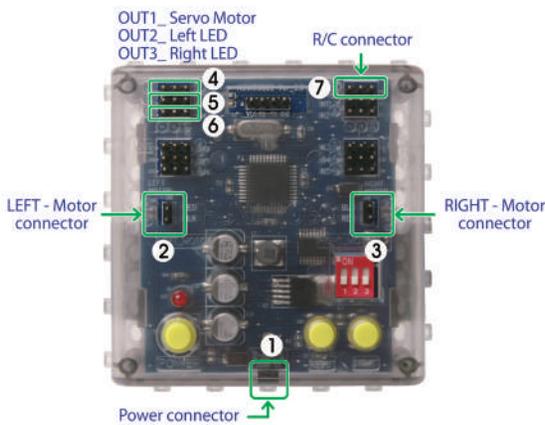
Completed





## How to prepare the MOTOR BIKE

### Connecting the mainboard



### Connect in this order.

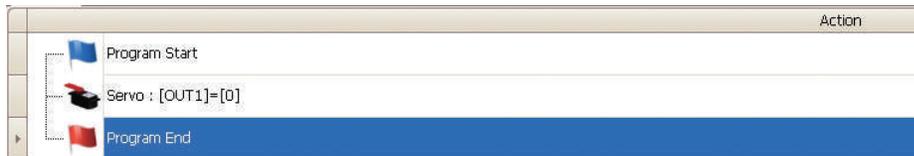
1. Connect Battery case to POWER connector.
2. Connect Left DC motor to LEFT-Motor connector.
3. Connect Right DC motor to RIGHT-Motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect Left LED board to OUT2 of OUTPUT connector.
6. Connect Right LED board to OUT3 of OUTPUT connector.
7. Connect RC receiver to Remote Control connector.

 The DC motor red wire must be connected to positive  $\oplus$ , the black wire to the negative  $\ominus$ .

 Insert the black wire of 3P electric wire into the negative  $\ominus$ .

### Servo motor-Zero Point Adjustment

1. Connect the servo motor to the mainboard. From mainboard connect it to the PC.
2. Run Compiler Program.



3. Press the button 'Download', power on the mainboard.
4. Fix the servo motor horn to the servo motor by using a small servo bolt illustrated in the right picture.



### Program Download

1. Create 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  $\rightarrow$  Power ON)

\* Refer to 「[HunaRobo Compiler Manual](#)」 on how to create more detailed programs and how to download them.

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

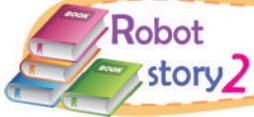
\* For more program examples, visit our reference room. (HunaRobo on our web site, [www.hunarobo.com](http://www.hunarobo.com))



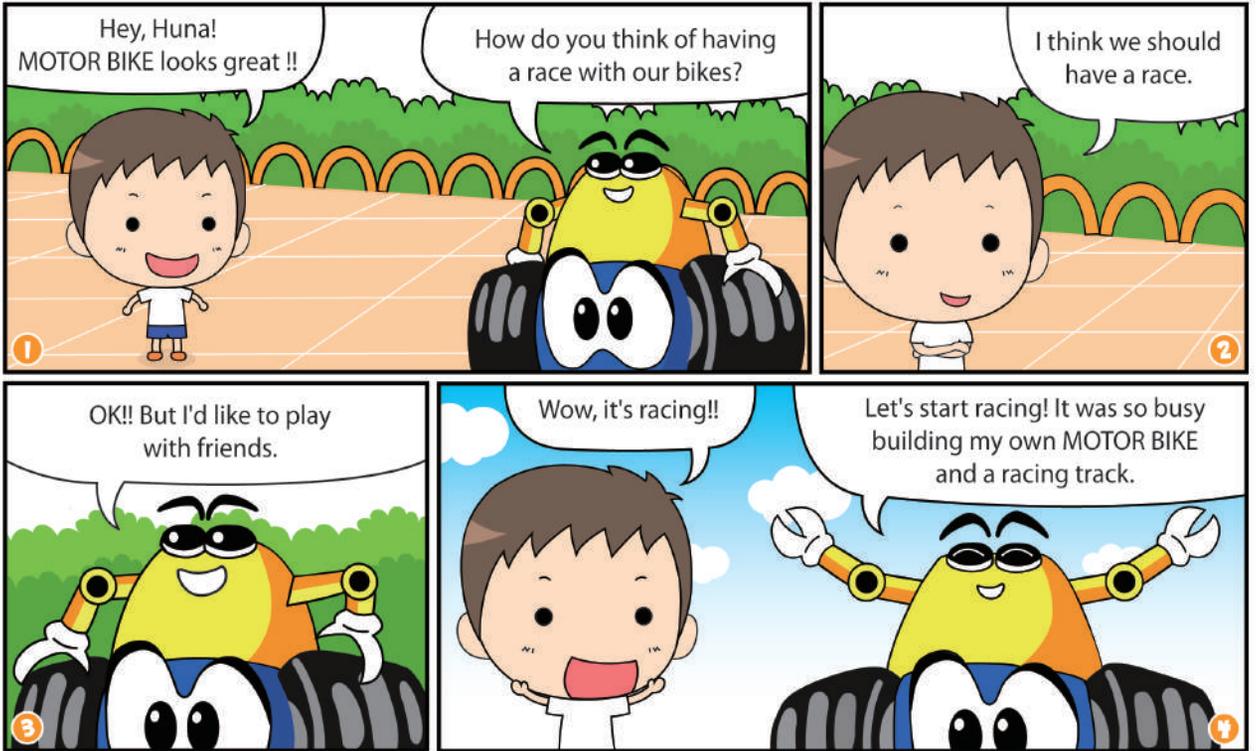
7. What is the name of device that resembles a stairway case that we use to carry people and cargo unceasingly in a upwards or downwards motion?

## Program Example

Action	No
Program Start	0
Remocon : [Up] {	1
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	2
Servo : [OUT1]=[0]	3
END }	4
Remocon : [Down] {	5
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=10]	6
Servo : [OUT1]=[0]	7
END }	8
Remocon : [Left] {	9
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	10
Servo : [OUT1]=[45]	11
LED : [OUT2]=[ON]	12
END }	13
Remocon : [Right] {	14
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	15
Servo : [OUT1]=[-45]	16
LED : [OUT3]=[ON]	17
END }	18
Remocon : [Up + Left] {	19
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	20
Servo : [OUT1]=[40]	21
LED : [OUT2]=[ON]	22
END }	23
Remocon : [Up + Right] {	24
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	25
Servo : [OUT1]=[-40]	26
LED : [OUT3]=[ON]	27
END }	28
Remocon : [Down + Left] {	29
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=10]	30
Servo : [OUT1]=[40]	31
LED : [OUT2]=[ON]	32
END }	33
Remocon : [Down + Right] {	34
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=10]	35
Servo : [OUT1]=[-40]	36
LED : [OUT3]=[ON]	37
END }	38
Remocon : [KEY OFF] {	39
DC motor 1 : [Both MOTOR1]=[Stop]	40
Servo : [OUT1]=[0]	41
LED : [OUT2]=[OFF], [OUT3]=[OFF]	42
END }	43
Program End	44



## Having a Motor Bike race with your friends



Design a racing track and have a race with your friends.



Blank lined area for drawing and writing.

Robot story 1

Let's move objects - Conveyer

1 A escalator at a department store is powerful. Because no matter how many people there are, it can carry them.

That's right~!! A escalator moves using a belt conveyor.

2 A belt conveyor? Is that a belt around our waist?

3 Ha ha.. No no.. A belt conveyor is machine that move objects along on a rubber belt that was placed on a conveyor machine.

Then, what is a conveyor?

4 A conveyor is a mechanism that carries objects. It is frequently used in factories because it carry things over a desired distance continuously.

5 So, they use it a lot especially in factories?

Um.. A heavy object is moved and time is saved. It is used as a moveable worktable for factory workers. Because of this, time can be saved in the manufacturing process.

6 There are many ways to manufacture things in a factory. Apart from a belt conveyor, are there any other uses for the conveyor?

7 Sure! There are many ways~. There is a chain conveyor that convey objects with a chain that hangs and there is a fluid conveyor that convey a object with water in a huge pipe.



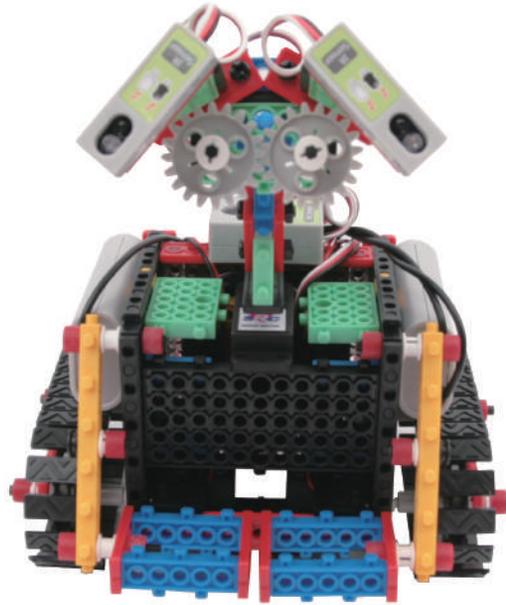
## How to make a robot that moves along with caterpillar tracks



### HUNA - E 2



HUNA-E is a model that resembles a character, the much beloved character from a famous animation. HUNA-E is the abbreviation for "HUMAN & NATURE-EARTH". It hopes to create a reality where humans and nature can live harmoniously together.



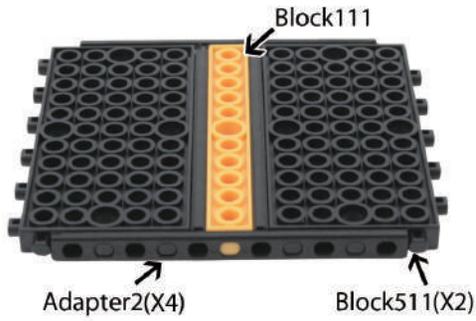
### Prepare parts for assembly

	Block511	x6		Frame11	x6		<b>Mainboard</b> x1
	Block111	x5		Frame5	x10		
	Block15	x8		Adapter2	x4		<b>Mic Sensor</b> x1
	Block35	x6		Adapter1	x11		
	Gear(M)	x2		L Adapter	x4		<b>IR Sensor</b> x2
	Sprocket	x4		Connection Shaft	x4		
	DC Motor	x2		Shaft(S)	x8		<b>Battery Case</b> x1
	Servo Motor	x1		Shaft(M)	x2		
	Caterpillar Track	x50		Half Bush	x14		
	Nut	x5		Bush	x8		
				Red Bush	x16		
				Coupling	x4		
				Bolt(S)	x2		
				Bolt(M)	x2		
				Bolt(L)	x1		



9. What do we call the phenomenon when substances change directly to gas-like state if it is heated without changing from solid to liquid first?

1



Connect two 「block511」s and a 「block111」 with four 「adapter2」s.

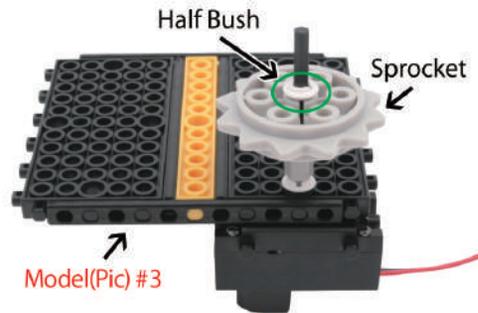
2



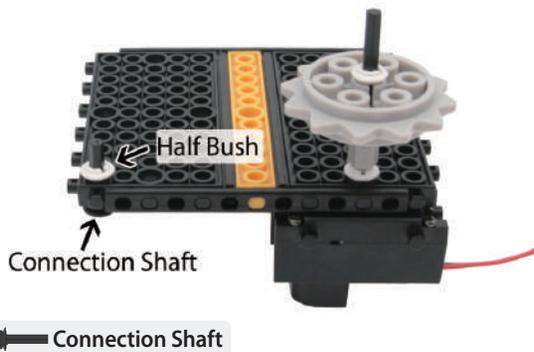
3



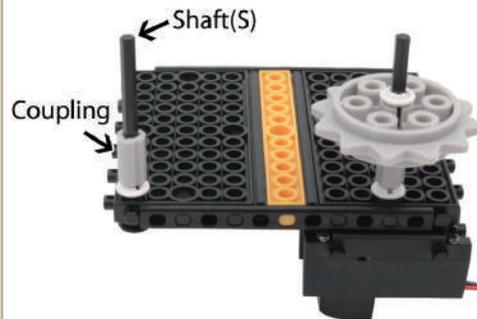
4

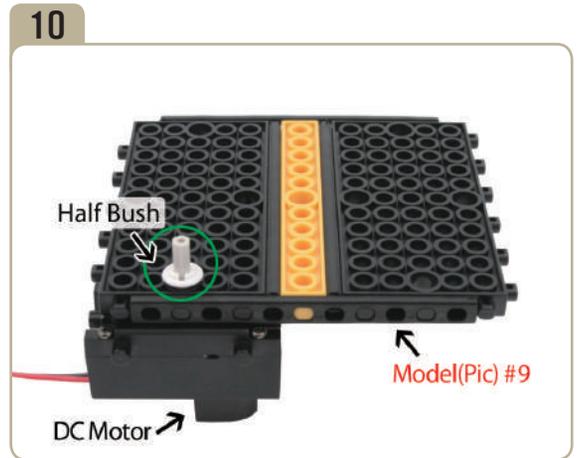
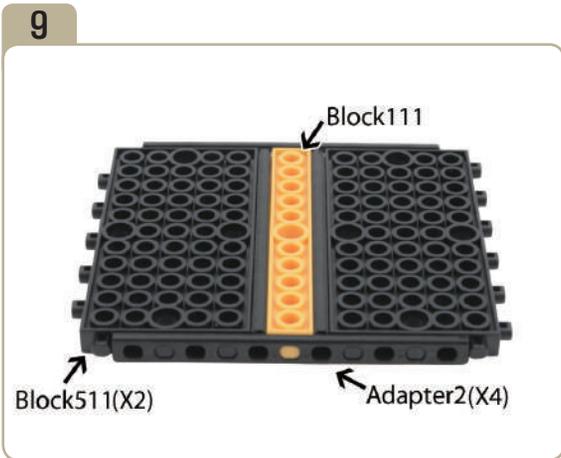
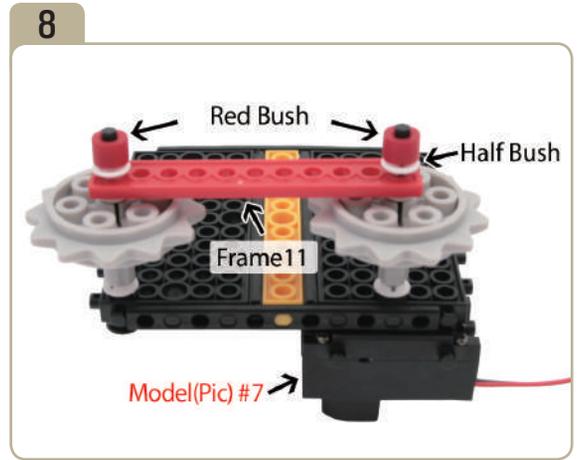
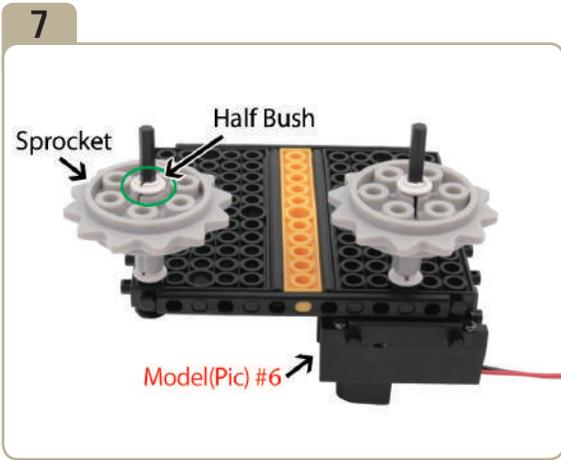


5

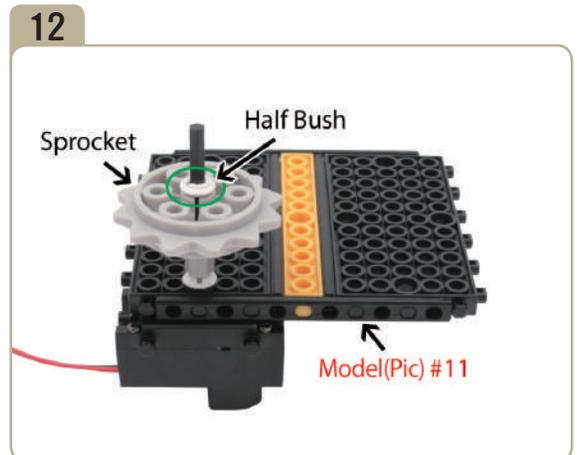
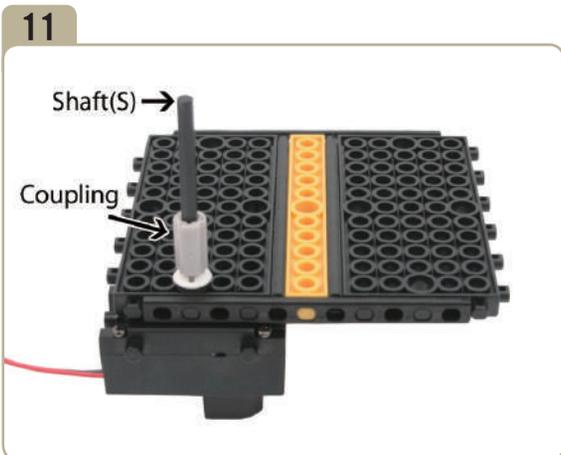


6

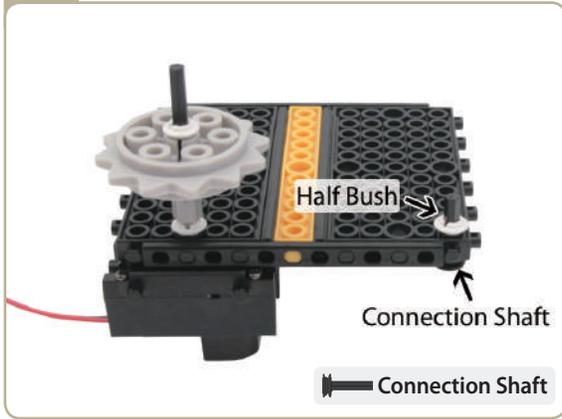




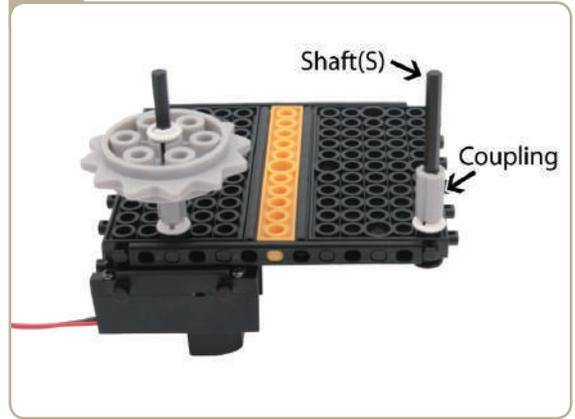
Connect two 「block511」s and a 「block111」 with four 「adapter2」s.



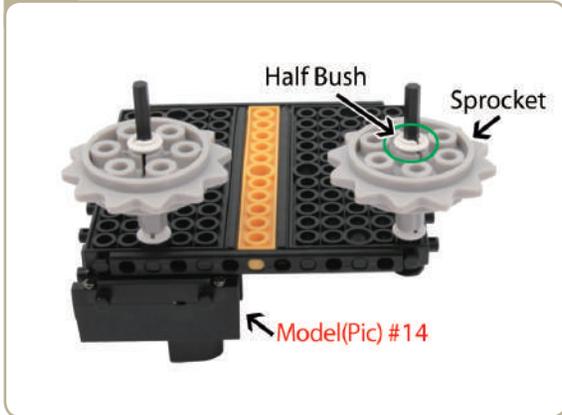
13



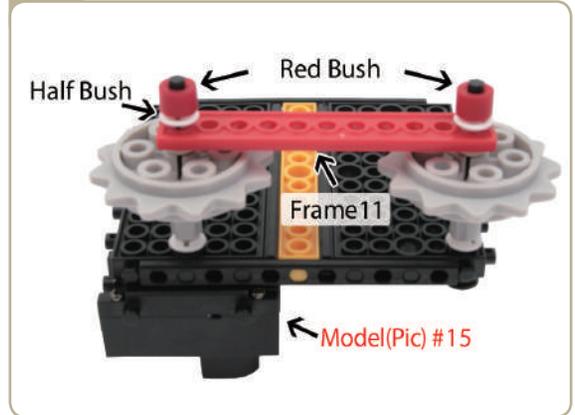
14



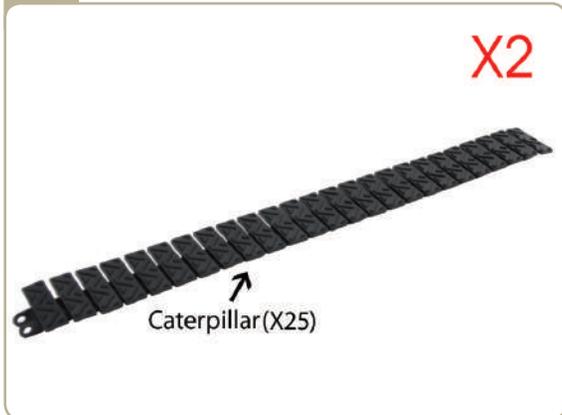
15



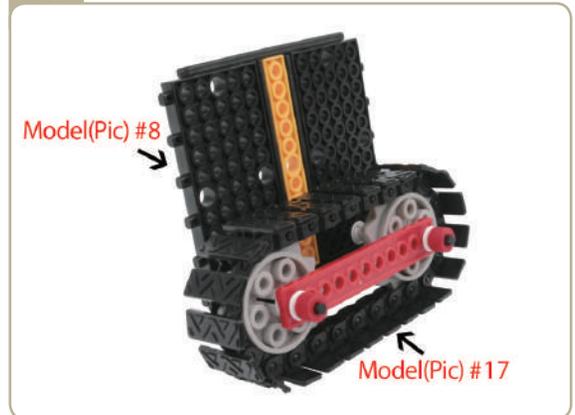
16



17



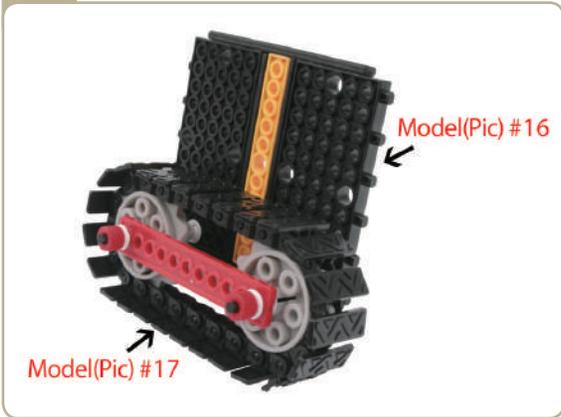
18



Connect twenty five caterpillar tracks.  
(Assemble two identical models.)

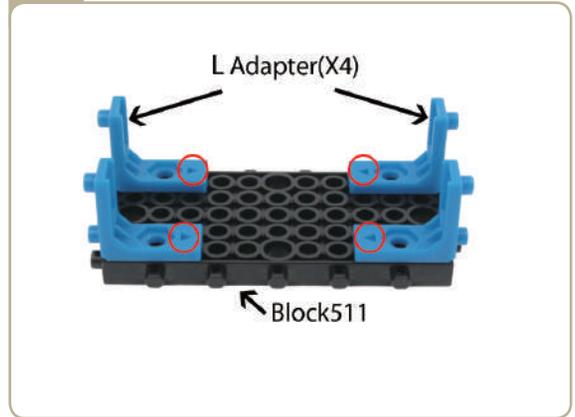
Connect a previously constructed part of model(pic)#17 to model(pic)#8.

19



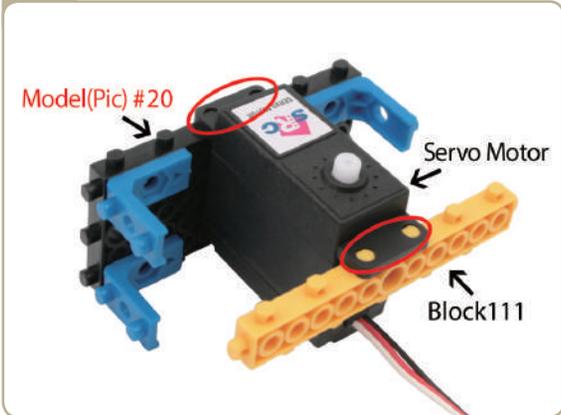
Connect a previously constructed part of model(pic)#17 to model(pic)#16.

20

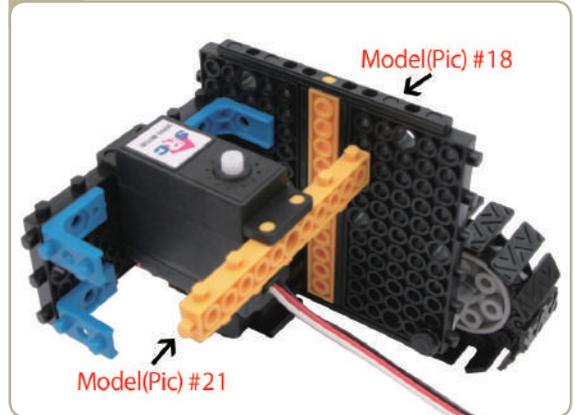


Attach four 'L' adapters to 「block511」. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

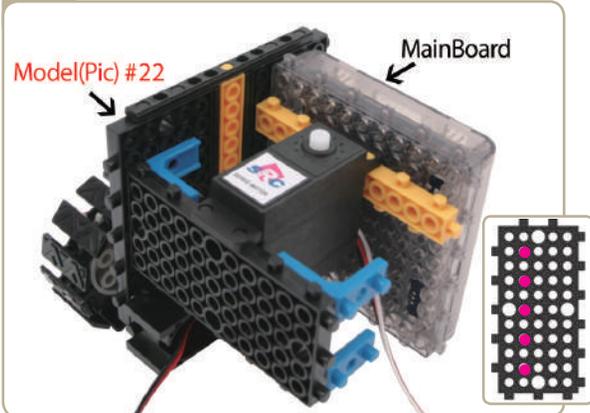
21



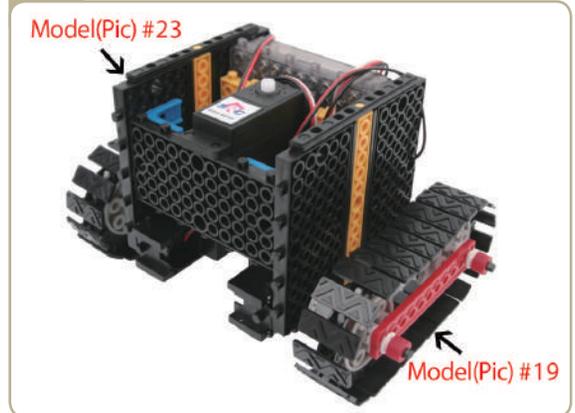
22



23

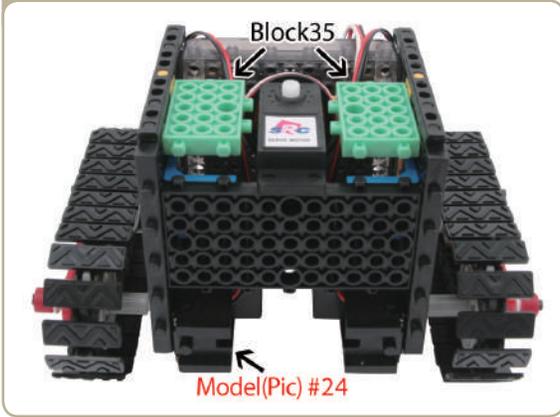


24

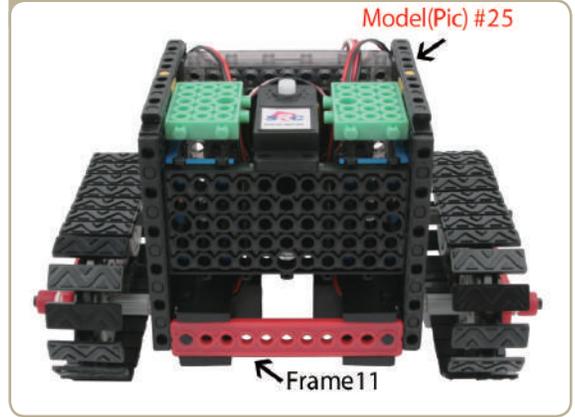


11. What do we call the phenomenon that changes gasses to liquids in colder environments or causes solids to melt?

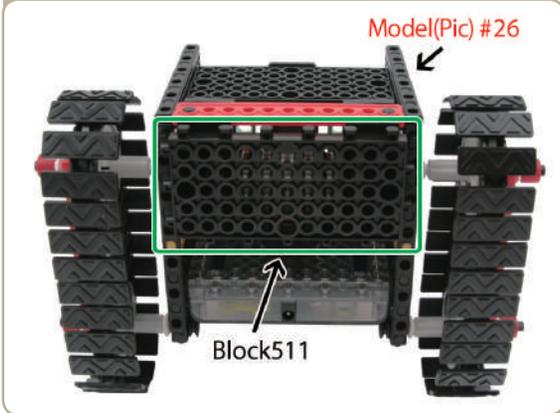
25



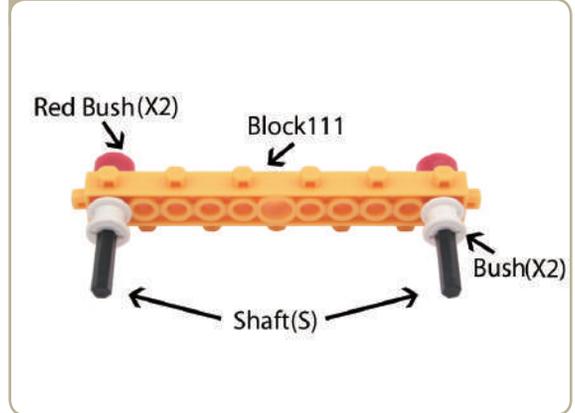
26



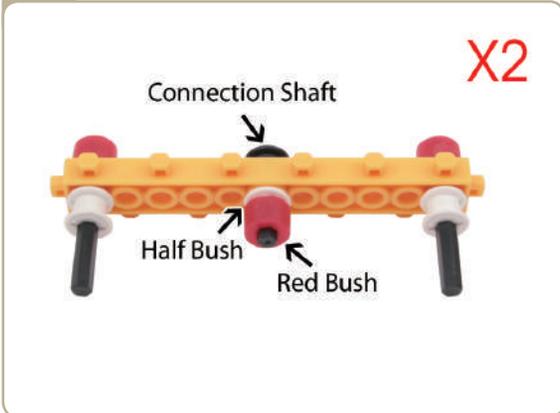
27 ( Bottom of model(Pic)#26 )



28

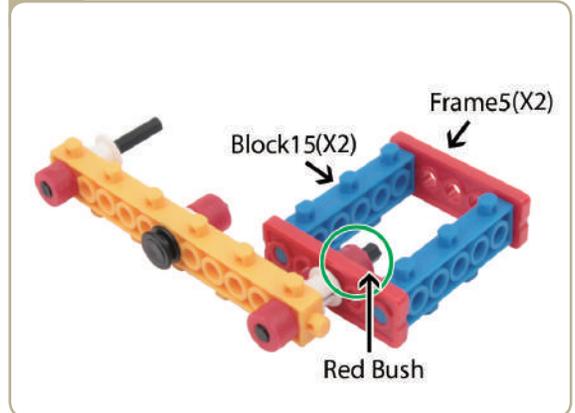


29



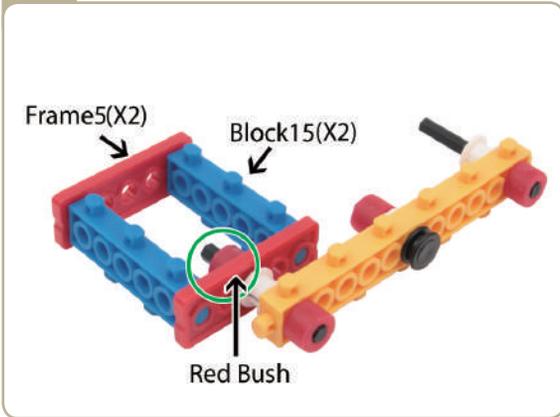
Assemble two identical models.

30



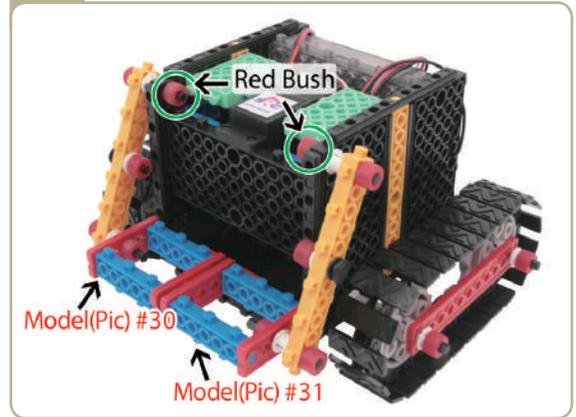
Connect two 「block15」s and two 「frame5」s, then combine it with model(pic)#29 with a red bush.

31



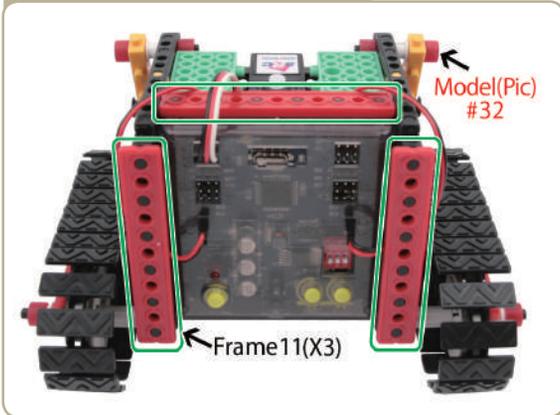
Assemble using the same method as model(pic)#30, but in reverse.

32



Connect model(pic)#31 and model(pic)#30 to model(pic)#27 with red bush.

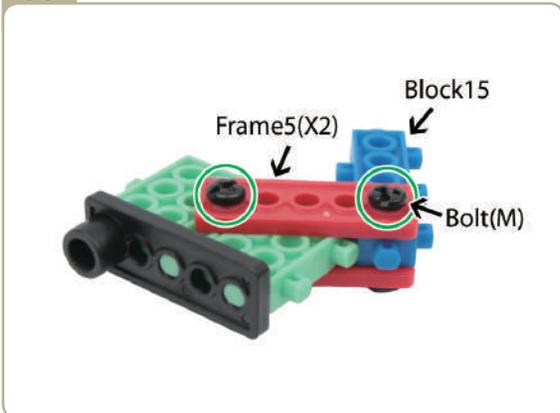
33 (Back of model(Pic)# 32)



34

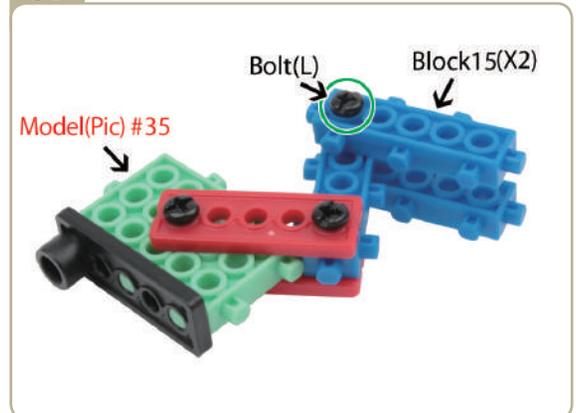


35



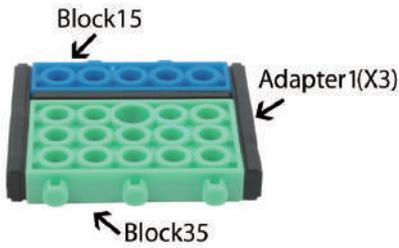
Fix two 「frame5」s and a 「block15」 to model(pic)#34 with medium bolts. (Fasten tightly.)

36

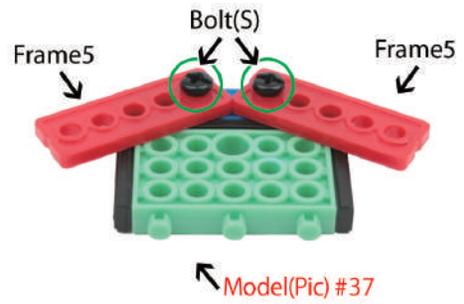


Fix two 「block15」s to model(pic)#35 with a long bolt. (Fasten tightly.)

37

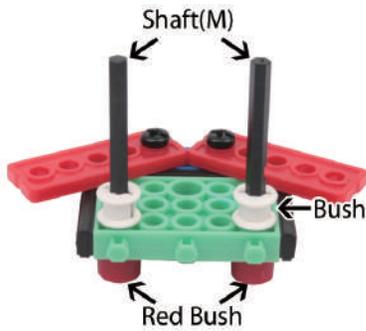


38

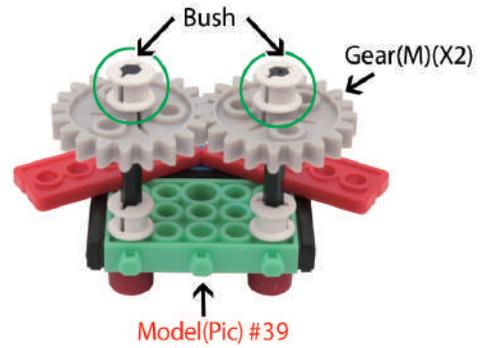


Fix two 「frame5」s to model(pic)#37 with short bolts. (Fasten tightly.)

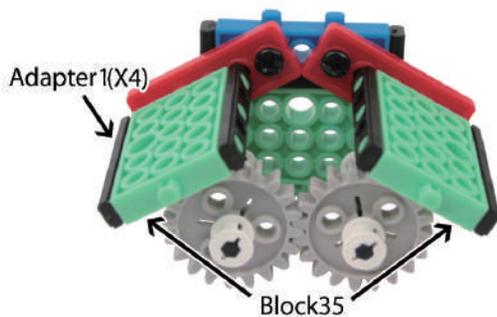
39



40

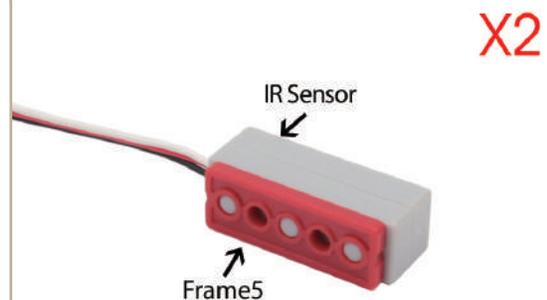


41



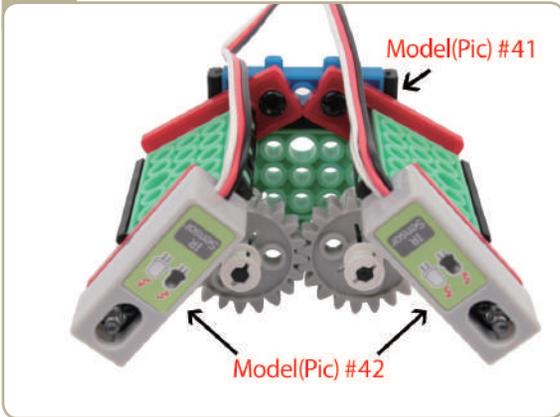
Connect two 「block35」s to model(pic)#40 and then attach four 「adapter1」s to 「block35」.

42

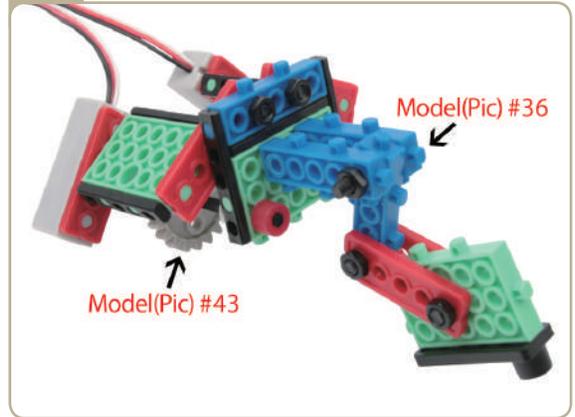


Assemble two identical models.

43

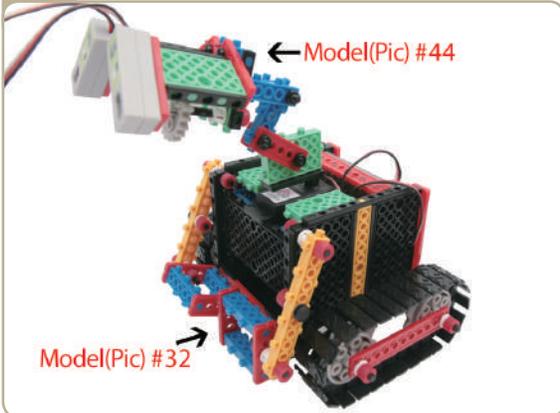


44



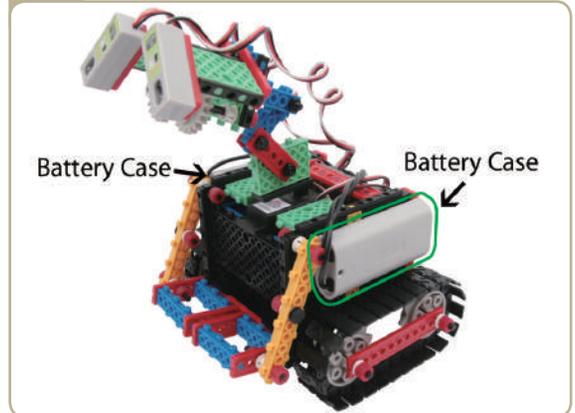
Connect model(pic)#36 to the back of model(pic)#43.

45

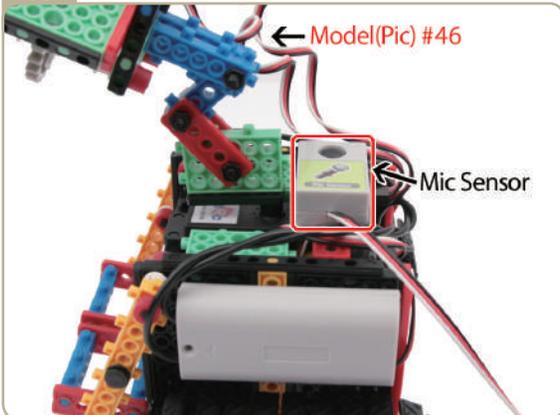


After adjusting zero point of servo motor, connect model(pic)#44 to model(pic)#32.

46



47



Completed

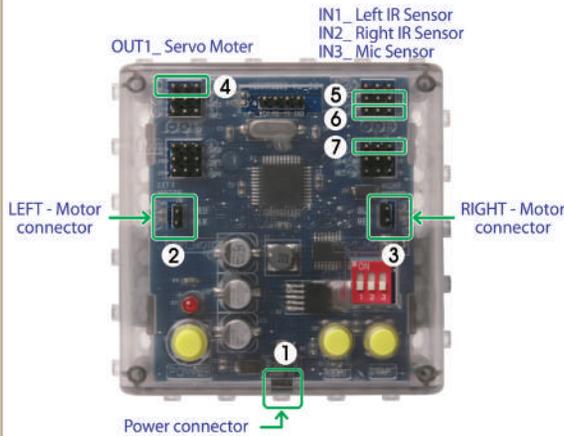


13. What do we call the phenomenon that emits incredible amounts of energy in all directions?



## How to prepare the HUNA-E

### Connecting the mainboard



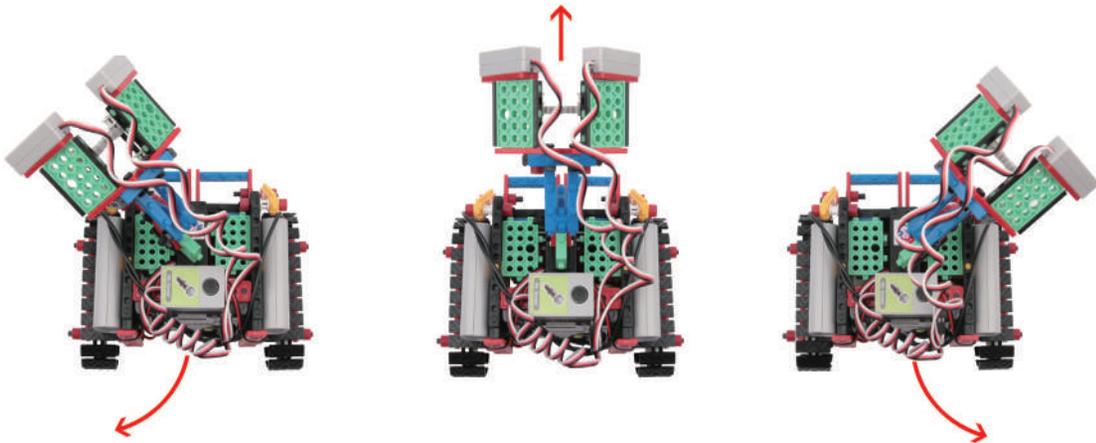
### Connect in this order.

1. Connect Battery case 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 Mic sensor to IN3 of INPUT connector.

The DC motor red wire must be connected to positive  $\oplus$ , the black wire to the negative  $\ominus$ .

Insert the black wire of 3P electric wire into the negative  $\ominus$ .

### Motion Pattern



**HINT 1.** If Mic Sensor is activated, robot will run forward.

**HINT 2.** If IR sensor is activated, It will go backward in the opposite direction of sensed direction with turning a head.

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

\* For more program examples, visit our reference room. (HunaRobo on our web site, [www.hunarobo.com](http://www.hunarobo.com))

### Program Download

1. Create 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  $\rightarrow$  Power ON)

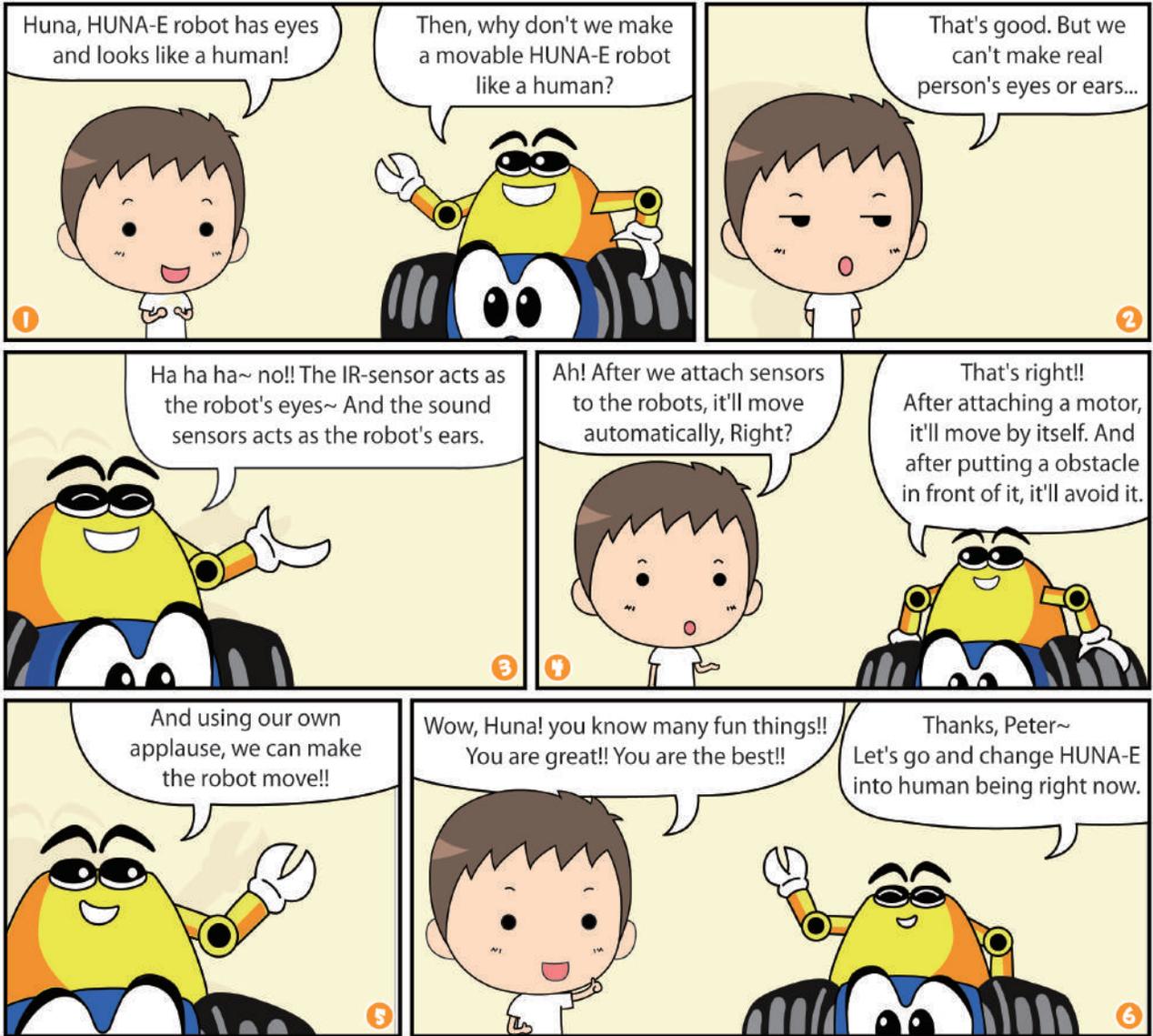
\* Refer to 「[HunaRobo Compiler Manual](#)」 on how to create more detailed programs and how to download them.

## Program Example

	ACC001	No
Program Start		0
IR : [IN1]=[None], [IN2]=[None] {		1
DC motor 1 : [Both MOTOR1]=[Stop]		2
Servo : [OUT1]=[0]		3
END }		4
IR : [IN1]=[Sense], [IN2]=[None] {		5
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=7]		6
Delay : [0.5 sec]		7
Servo : [OUT1]=[60]		8
Delay : [0.5 sec]		9
DC motor 1 : [L-MOTOR1]=[Backward],[Speed=7]		10
DC motor 1 : [R-MOTOR1]=[Stop]		11
Delay : [1 sec]		12
DC motor 1 : [Both MOTOR1]=[Stop]		13
Delay : [1 sec]		14
END }		15
IR : [IN1]=[None], [IN2]=[Sense] {		16
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=7]		17
Delay : [0.5 sec]		18
Servo : [OUT1]=[-60]		19
Delay : [0.5 sec]		20
DC motor 1 : [R-MOTOR1]=[Backward],[Speed=7]		21
DC motor 1 : [L-MOTOR1]=[Stop]		22
Delay : [1 sec]		23
DC motor 1 : [Both MOTOR1]=[Stop]		24
Delay : [1 sec]		25
END }		26
IR : [IN1]=[Sense], [IN2]=[Sense] {		27
DC motor 1 : [Both MOTOR1]=[Backward],[Speed=7]		28
Delay : [0.5 sec]		29
END }		30
Mic : [IN3]=[None] {		31
DC motor 1 : [Both MOTOR1]=[Stop]		32
Servo : [OUT1]=[0]		33
END }		34
Mic : [IN3]=[Sound] {		35
DC motor 1 : [Both MOTOR1]=[Forward],[Speed=7]		36
Servo : [OUT1]=[60]		37
Delay : [0.5 sec]		38
Servo : [OUT1]=[-60]		39
Delay : [0.5 sec]		40
Servo : [OUT1]=[60]		41
Delay : [0.5 sec]		42
Servo : [OUT1]=[-60]		43
Delay : [0.5 sec]		44
DC motor 1 : [Both MOTOR1]=[Stop]		45
Delay : [1 sec]		46
END }		47
Program End		48



Let's change HUNA-E into human being!





## It is so flashy! - Light Energy

1 Hey, Huna! Our family moved in to a new house. It's a greathouse because it gets a lot of sunshine.

It's good for you to get enough sunlight. These days, we can also create electricity with sunlight.

2 Wow, can you create electricity with it?

3 Yes! Originally, batteries created electricity. But with solar cells, we can store sunlight in the form of electricity.

4 So, does that technology use sunlight?

Right, Also, for a long as the sun exist well be able to continuously use light energy.

5 However, we haven't developed much technology using light energy yet. So It is not used extensively. We can't use light energy directly and it requires special facilities. There is so much light energy from the sun, but actually the amount of light energy in use is very small.

6 So, we can't use all of it?

However, this light energy is eco-friendly, it will be used in the future.

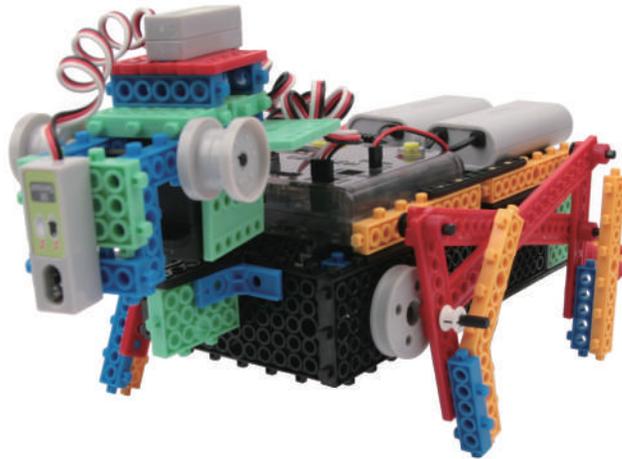


## Understanding the principles of gears and making a light sensing robot

### A light sensing robot 'HOT-DOG'



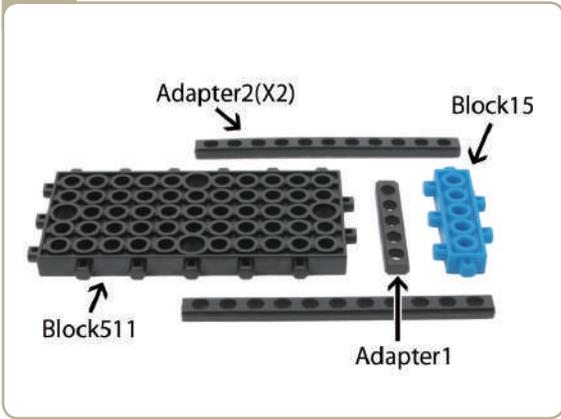
This robot was designed to resemble the shape of a four-legged puppy. It uses a DC motor to move along like a puppy. If we install a CdS sensor in the head of puppy, it will operate in the presence of light, and will stop operating in the dark. If the infrared sensor on it's nose perceives objects, the puppy will wag it's tail and reverse into the opposite direction. It changes direction with its tail.



### Prepare parts for assembly

	Block523	x2		Frame21	x4	
	Block511	x5		Frame11	x4	
	Block90	x2		Frame5	x6	
	Block135	x3		Adapter2	x11	
	Block111	x6		Adapter1	x5	
	Block15	x10		L Adapter	x3	
	Block35	x6		Connection Shaft	x6	
	Motor Mount	x4		Shaft(S)	x2	
	Guide Wheel	x2		Shaft(M)	x2	
	Wheel(S)	x2		Shaft(L)	x2	
	Wheel(M)	x1		Half Bush	x6	
	Servo Motor	x1		Bush	x8	
				Red Bush	x8	
				Coupling	x2	
				Gear(S)		
				Gear(L)	x2	
				DC Motor	x1	

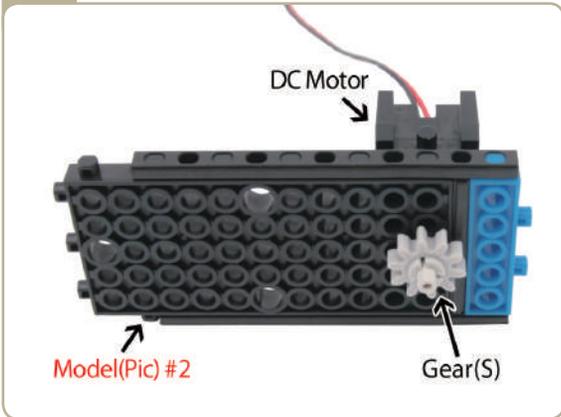
1



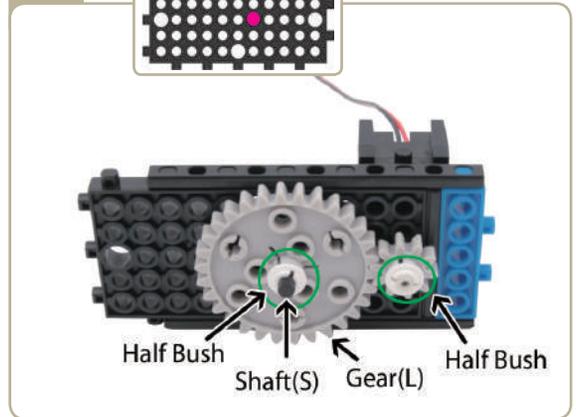
2



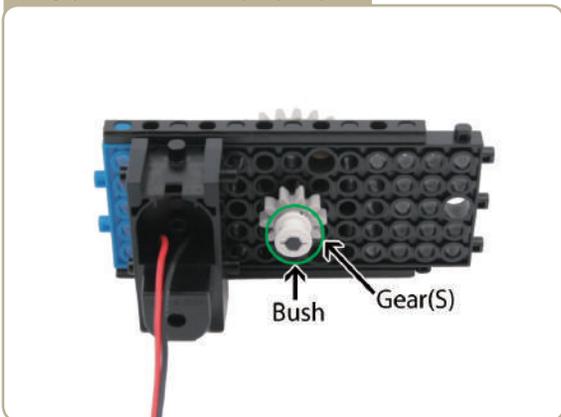
3



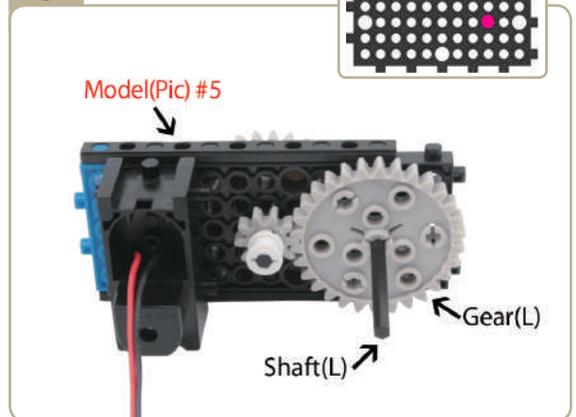
4



5 (Back of model(Pic)#4)



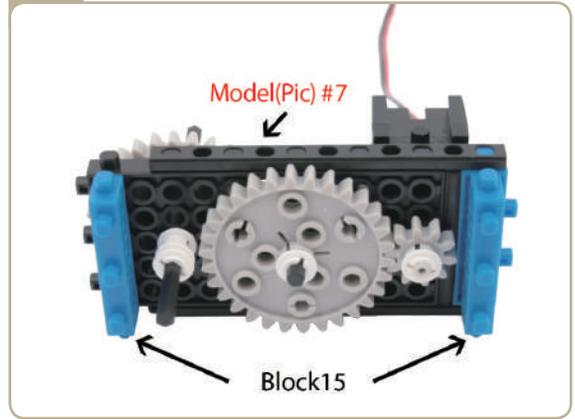
6



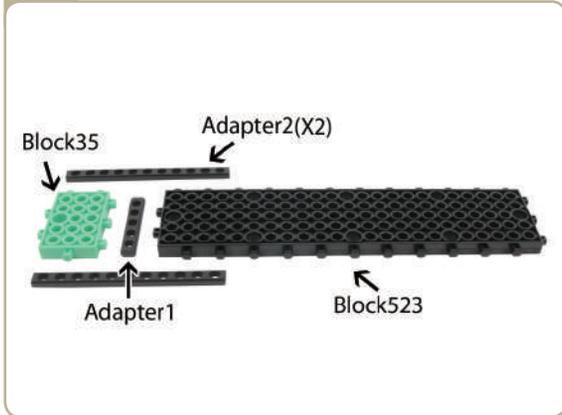
7 (Back of model(Pic)#6)



8



9

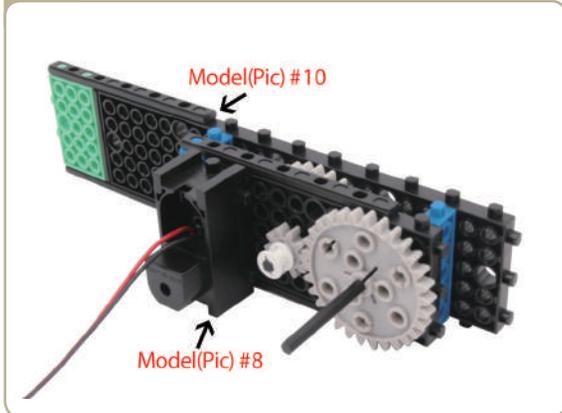


10



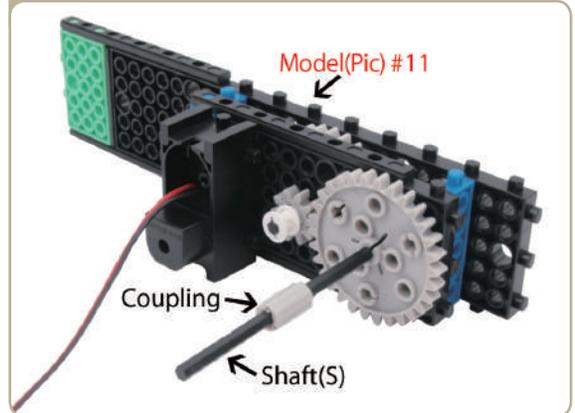
Assebmle two identical models.

11

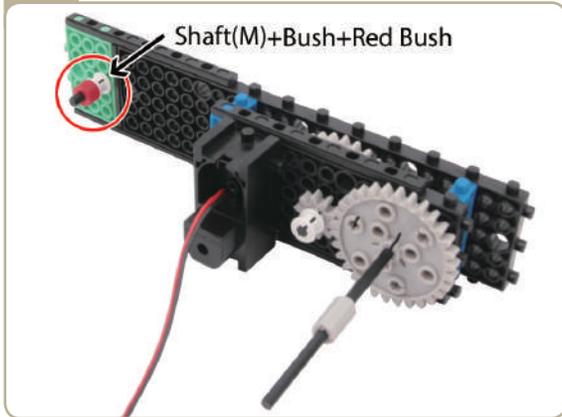


Connect a previously constructed part of model(pic)#10 to model(pic)#8.

12

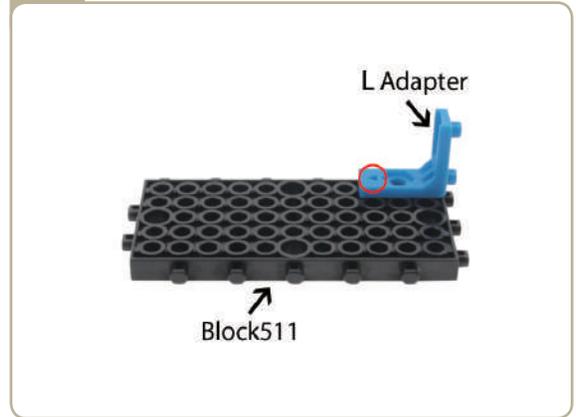


13



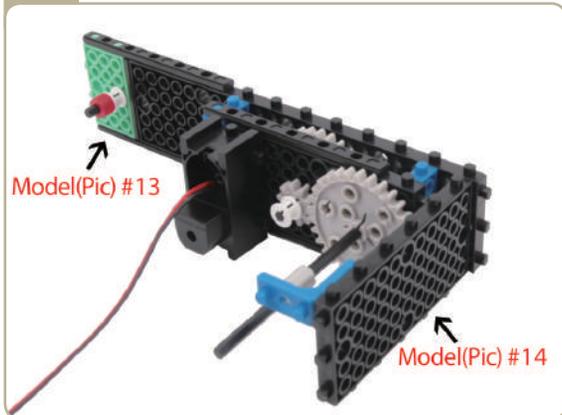
The back side fastens with a bush.

14

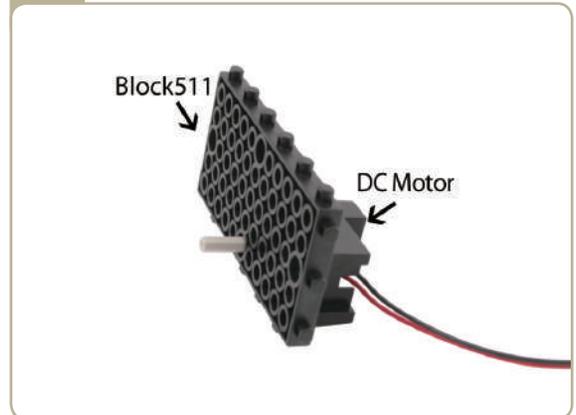


Attach a 'L' adapter to 'Block511'.  
(Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

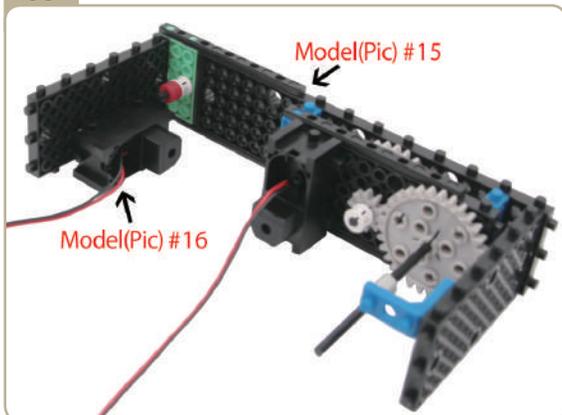
15



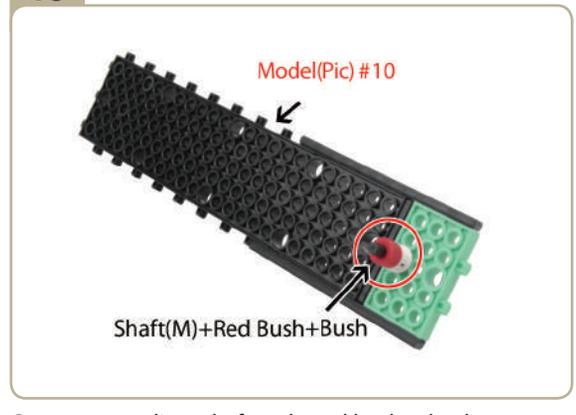
16



17



18

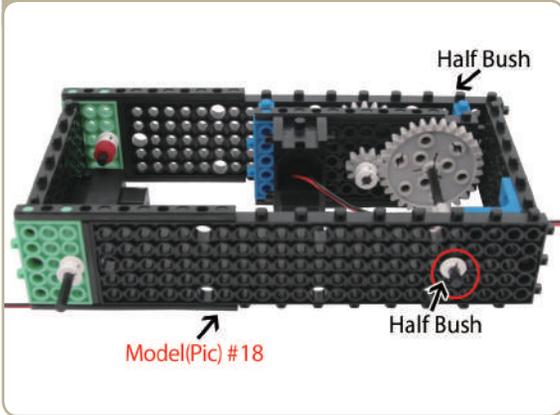


Connect a medium shaft and a red bush, a bush to a previously constructed parts of model(pic)#10 to model(pic)#8.(The back side fastens with a bush.)



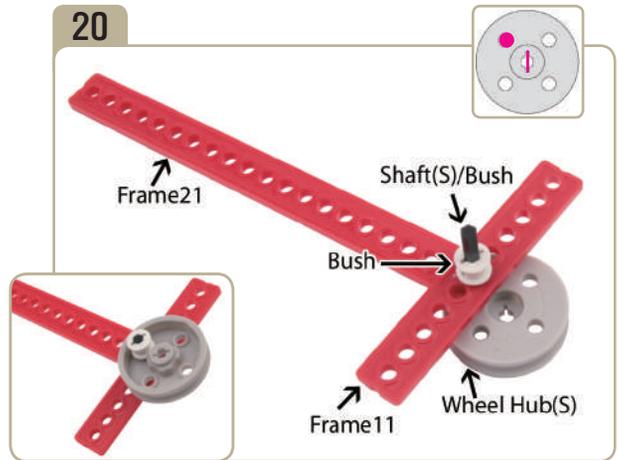
2. What is the name of the part that transmits power and rotation between two shafts?

19



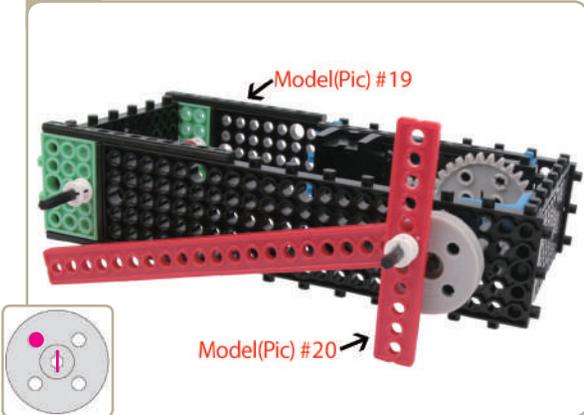
Combine model(pic)#18 with model(pic)#17. And then fix shaft with half bushes.

20



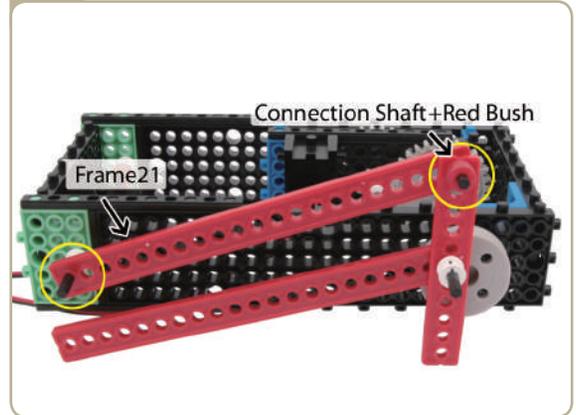
Connect the parts in the following order ;  
A short shaft → A small wheel hub → A 「frame21」  
→ A 「frame11」 → A bush. (The back side fastens with a bush.)

21



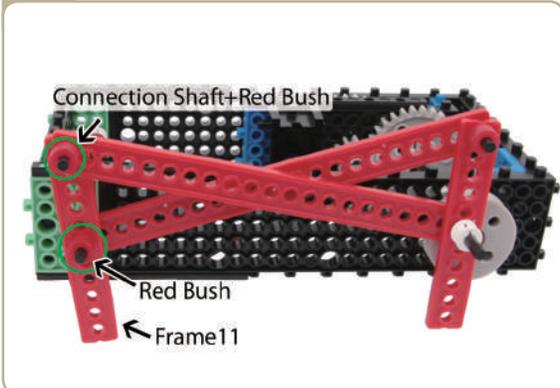
Combine model(pic)#20 with model(pic)#19.  
(Keep a close attention to the direction of small wheel hub.)

22



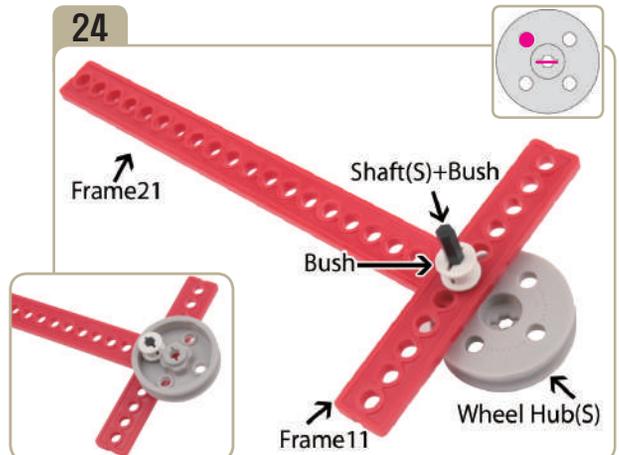
Connect a 「frame21」 to 「frame11」 of model(pic)#21 with a connection shaft and a red bush.

23



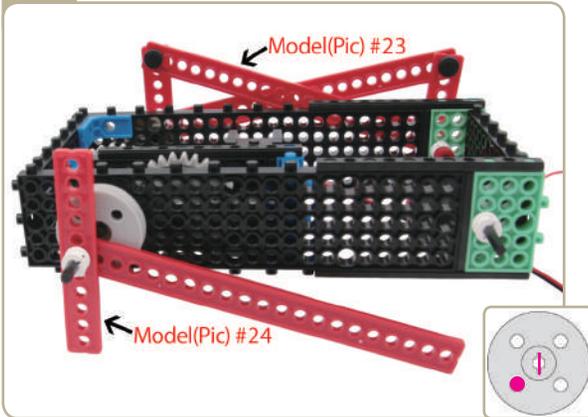
Connect a 「frame11」 to the medium shaft of model(pic)#22, then connect the other side of 「frame21」 that is connected to wheel shaft to it with a connection shaft and red bushes.

24



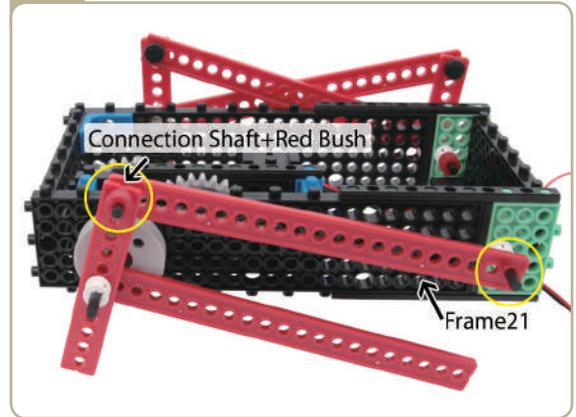
Connect the parts in the following order ;  
A short shaft → A small wheel hub → A 「frame21」  
→ A 「frame11」 → A bush.(The back side fastens with a bush.)

25



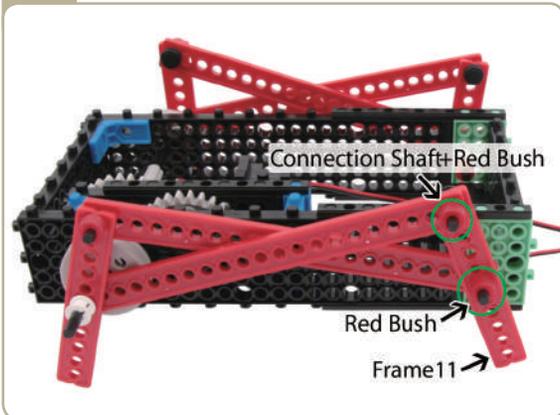
Combine model(pic)#24 with model(pic)#23.  
(Keep a close attention to the direction of small wheel hub.)

26



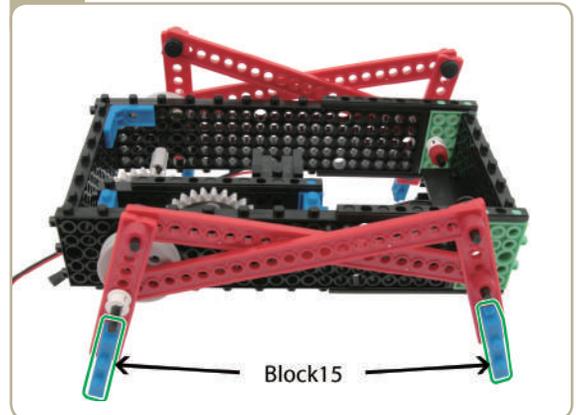
Connect a 「frame21」 to 「frame11」 of model(pic)#25 with a connection shaft and a red bush.

27

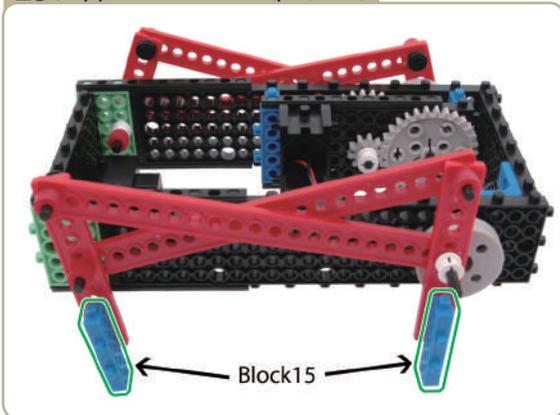


Connect a 「frame11」 to the medium shaft of model(pic)#26, then connect the other side of 「frame21」 that is connected to wheel shaft to it with a connection shaft and red bushes.

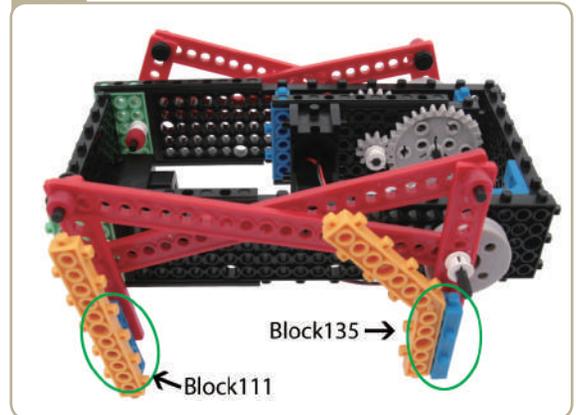
28



29 ( Opposite of model(pic)#28)

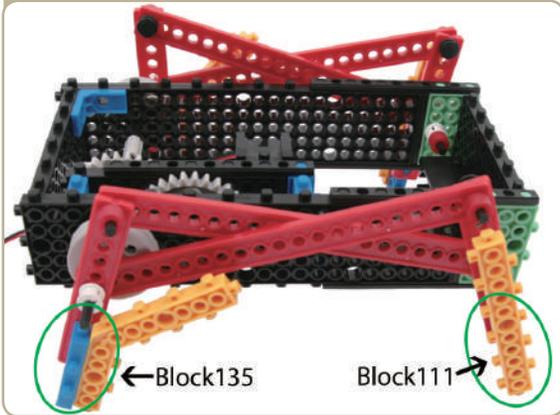


30



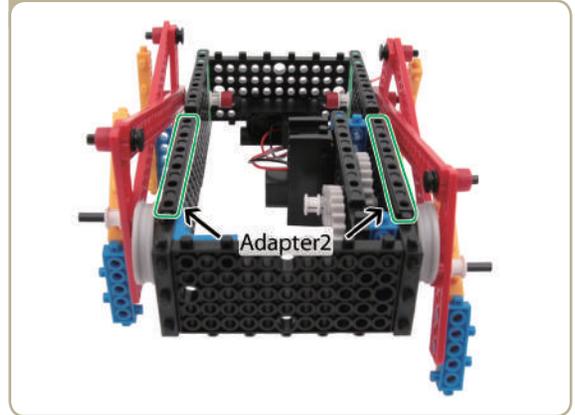
Attach a 「block111」 and a 「block135」 to model(pic)#29.  
(Keep a close attention to the position of blocks.)

31 ( Opposite of model(pic)#30)

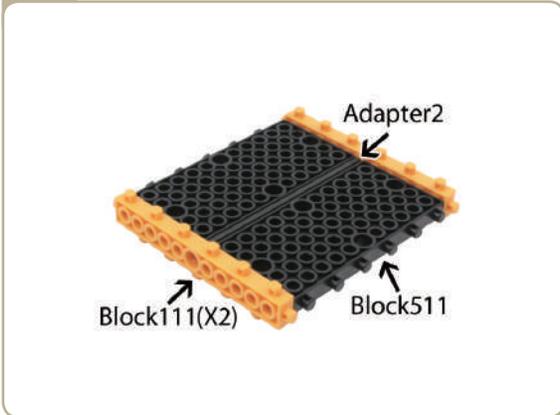


Attach a 「block111」and a 「block135」to the opposite of model(pic)#30. (Keep a close attention to the position of blocks.)

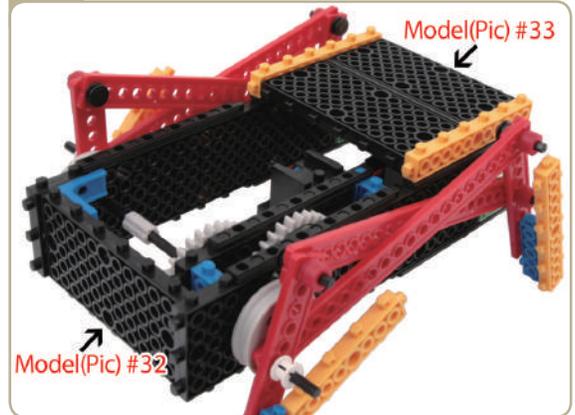
32



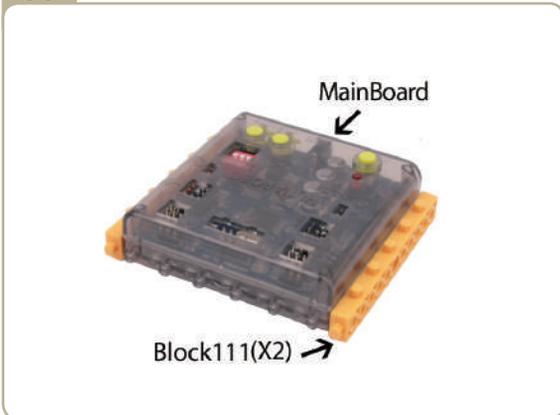
33



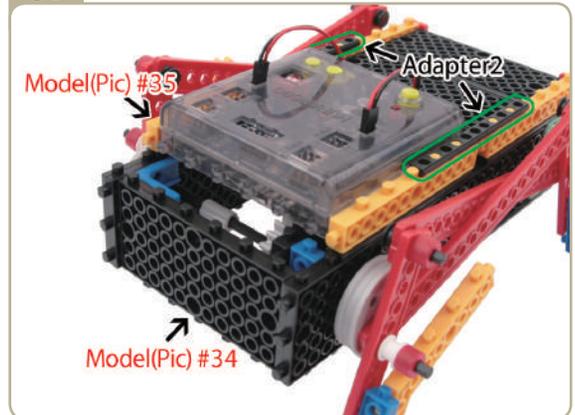
34



35

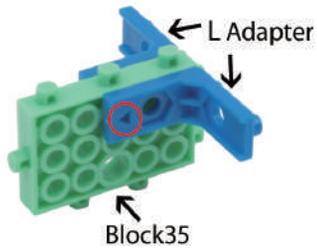


36



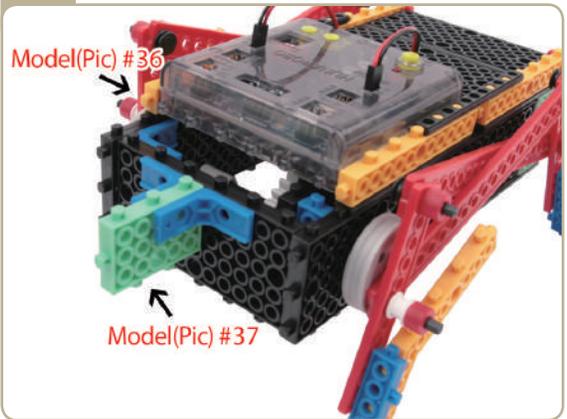
Connect model(pic)#35 to the front of model(pic)#34. And then attach two 「adapter2」s.

37

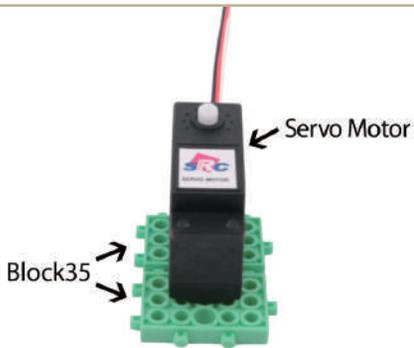


Attach two 'L' adapters to 'Block35'.  
(Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

38



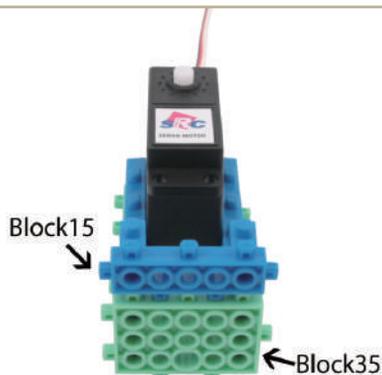
39



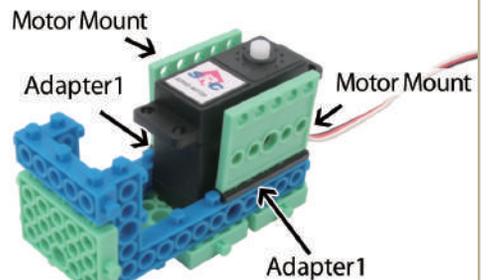
40



41



42



Attach two motor mounts to model(pic)#41 with two 'adapter1's.



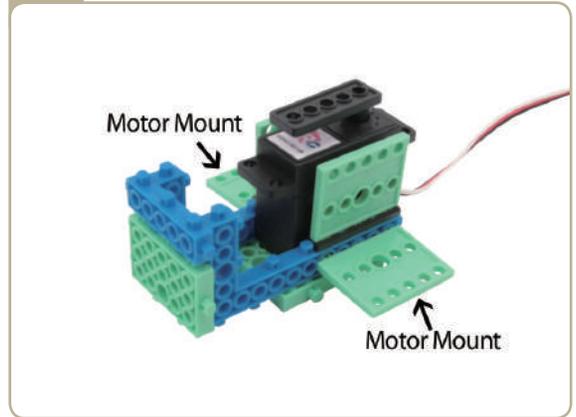
4. what is the name of the device that converts electrical energy to mechanical energy?

43

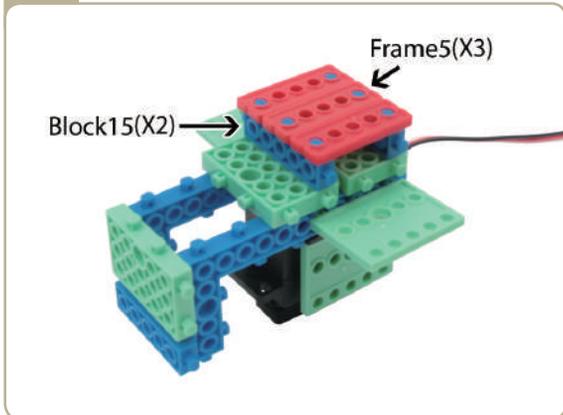


After adjusting zero point of servo motor, connect servo horn to model(pic)#42.

44

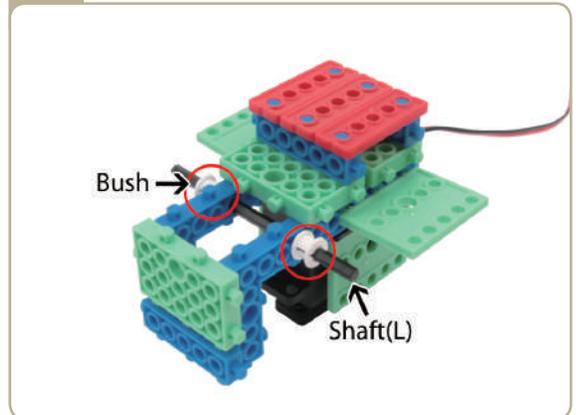


45

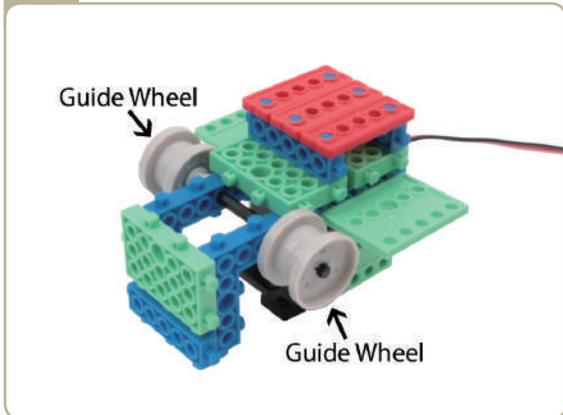


Turn model(pic)#44 upside down, then attach two 'block15's and three 'frame5's.

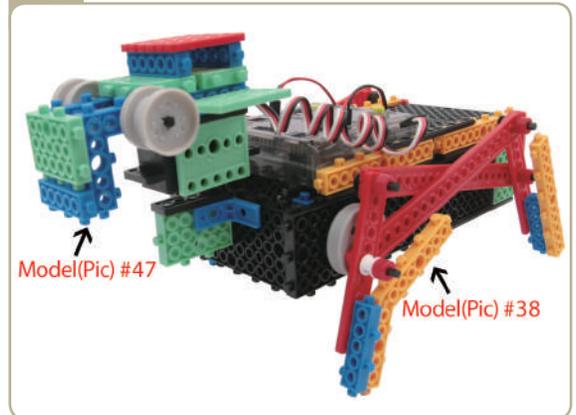
46



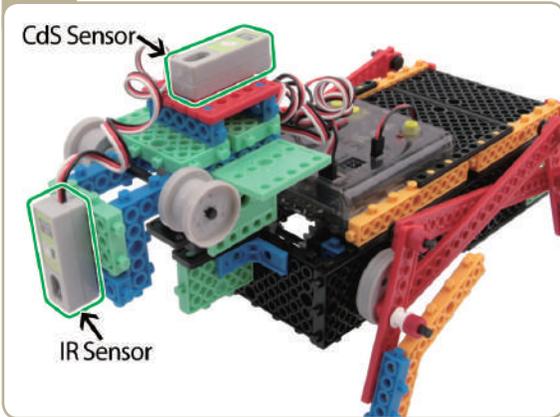
47



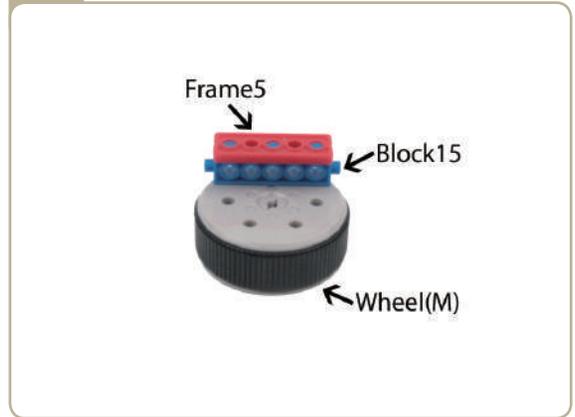
48



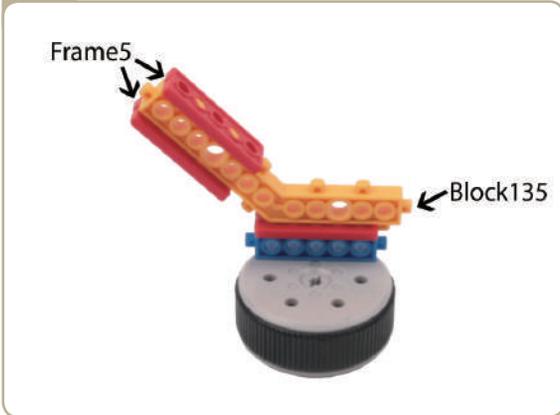
49



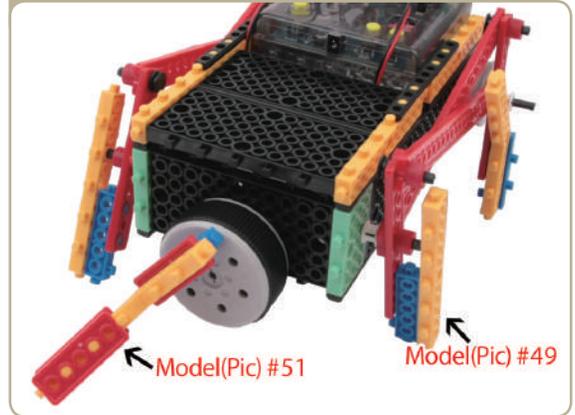
50



51

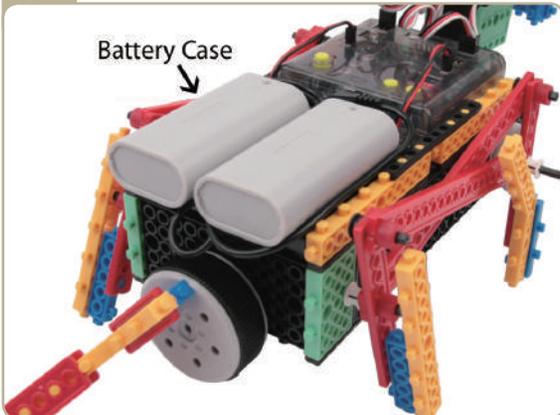


52

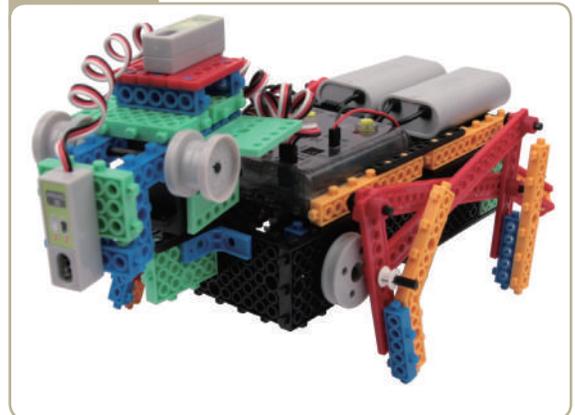


Connect model(pic)#51 to the back of model(pic)#49.

53

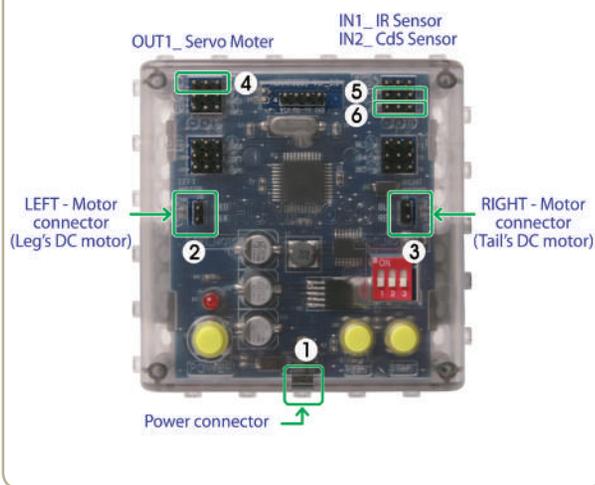


Completed



## How to operate the HOT-DOG

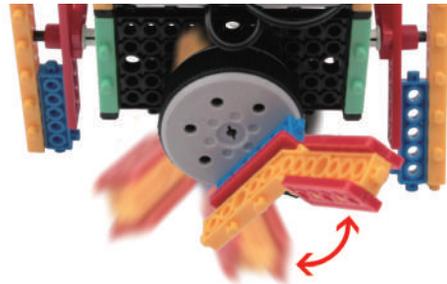
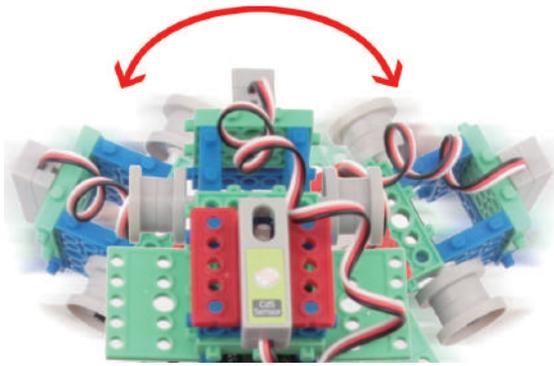
### Connecting the mainboard



### Connect in this order.

1. Connect Battery case to POWER connector.
2. Connect Leg's DC motor to LEFT-Motor connector.
3. Connect Tail's DC motor to RIGHT-Motor connector.
4. Connect Servo motor to OUT1 of OUTPUT connector.
5. Connect IR sensor to IN1 of INPUT connector.
6. Connect CdS sensor to IN2 of INPUT connector.

### Motion Pattern



- Hint 1.** If the IR sensor perceives an object, make the robot reverse and change direction with its wagging tail.  
**Hint 2.** If CdS-sensor perceives an object, it will cease all operations as if it was dead.

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

\* For more program examples, visit our reference room. (HunaRobo on our web site, [www.hunarobo.com](http://www.hunarobo.com))

### Program Download

1. Create 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)

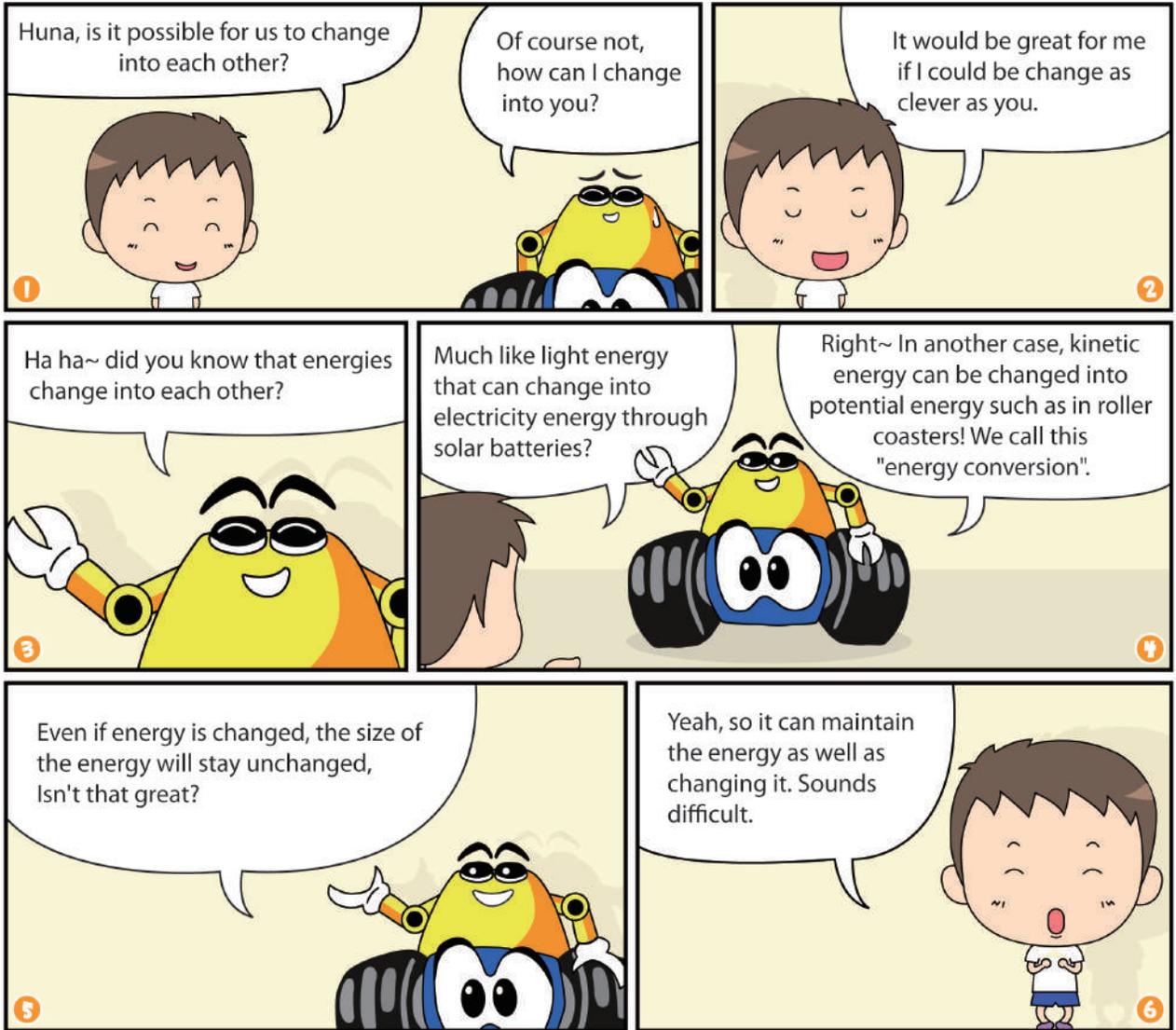
\* Refer to 「HunaRobo Compiler Manual」 on how to create more detailed programs and how to download them.

## Program Example

Action	No
 Program Start	0
 CdS : [IN2]=[Dark] {	1
 DC motor 1 : [Both MOTOR1]=[Stop]	2
<b>END }</b>	3
 CdS : [IN2]=[Light] {	4
 DC motor 1 : [L-MOTOR1]=[Forward],[Speed=10]	5
 DC motor 1 : [R-MOTOR1]=[Stop]	6
<b>END }</b>	7
 IR : [IN1]=[Sense] {	8
 Servo : [OUT1]=[-30]	9
 Delay : [0.5 sec]	10
 Servo : [OUT1]=[30]	11
 Delay : [0.5 sec]	12
 Servo : [OUT1]=[-30]	13
 Delay : [0.5 sec]	14
 Servo : [OUT1]=[30]	15
 DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	16
 Delay : [1 sec]	17
 DC motor 1 : [L-MOTOR1]=[Backward],[Speed=10]	18
 Delay : [2 sec]	19
<b>END }</b>	20
 Servo : [OUT1]=[0]	21
 Program End	22



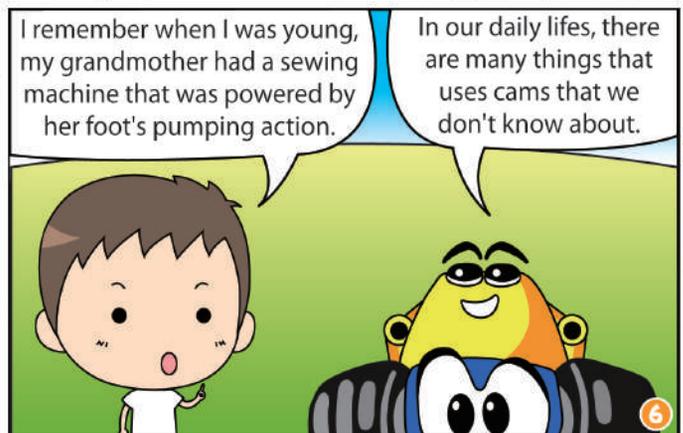
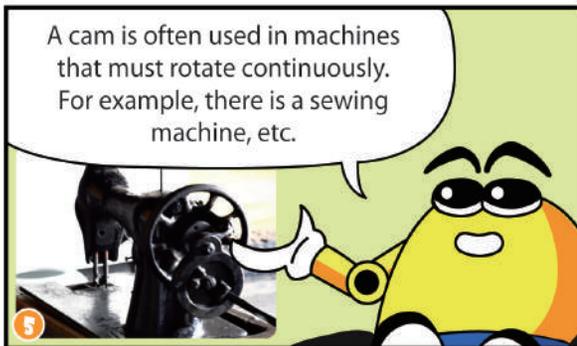
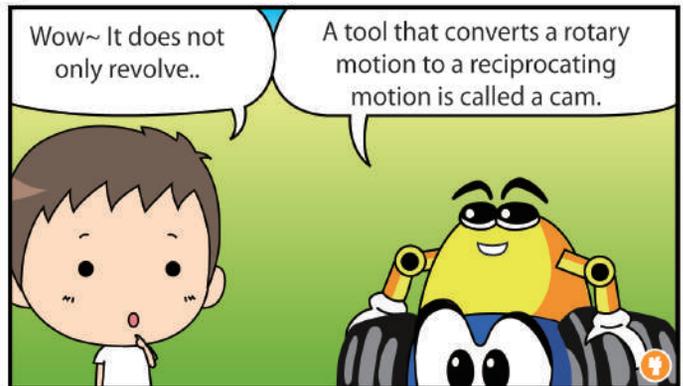
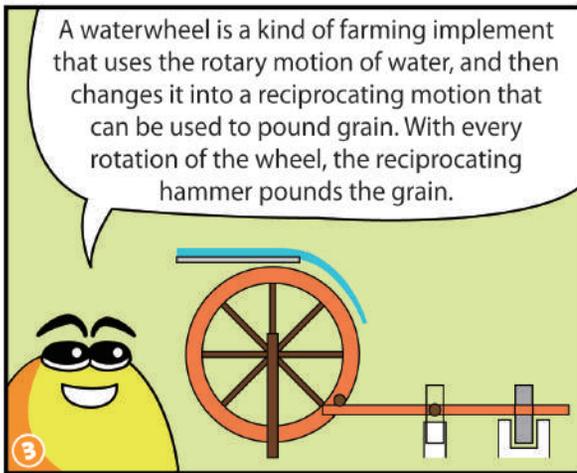
How energy can change into different form!



Let's have a look at energy conversion and see what kind of energy it can be changed into.



# I feel dizzy when I keep on turning and turning- Cams





## Making your own Robot

♣ Let's make my own model using the principle of Cams!

Draw a model what you want to make!

## "HUNAROBO" Dictionary

### ★ MBG [Megabit Gear]

This is a high speed modem that combines a interface function of Ethernet and Asymmetric Digital Subscriber Line(ADSL).

As ADSL modems are made in accordance with American National Standard Institute(ANSI) standard ANSI T1.413. It is typical ADSL technique to realize broad-band transmission using a telephone line according to dissemination of a computer communications network. Transmission speeds of a modem until now was 54kbps in analog, and 64/128kbps in the integrated service digital networks(ISDN). In comparison, ADSL's speeds of 640kbps is possible in the upstream band, and 6Mbps in the downstream band in the case of digital. The upstream band is used for communication from the end user to the telephone central office and the downstream band is used for communicating from the central office to the end user. And by using a existing analog telephone line, a special installation is not necessary.

Stable communication is possible in concurrence with installation because ADSL diagnose communications quality by itself and decide transmission speed. In terms of cost-effectiveness, ADSL has the merit that it can be build at a cost of one-third ~ one-fifth than general communications network installation cost.

### ★ Butane gas fuel cell

This is a fuel cell that generates electric energy using portable butane gas. After generating a potent hydrogen gas from butane gas, this battery uses the principle of electric energy generation to move hydrogen atoms through a Stack(a electricity generation equipment) and in this way electric energy is generated. This battery is a nonpolluting clean fuel, whose final product is water. And it can be used as a potable device's power supply, emergency power supply in the event of a power outage, outdoor leisure activities portable equipment's power supply, etc.

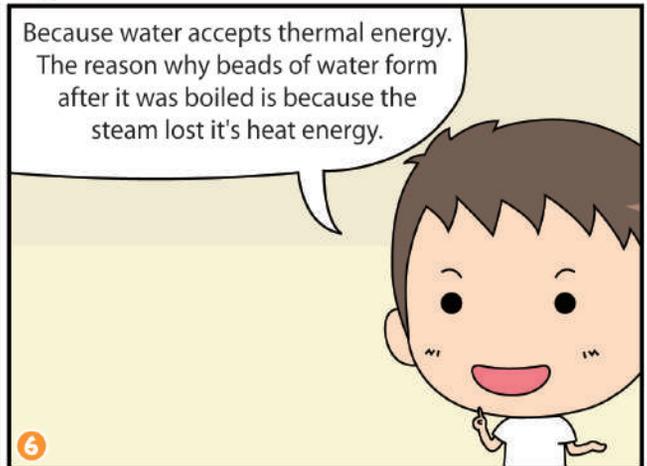
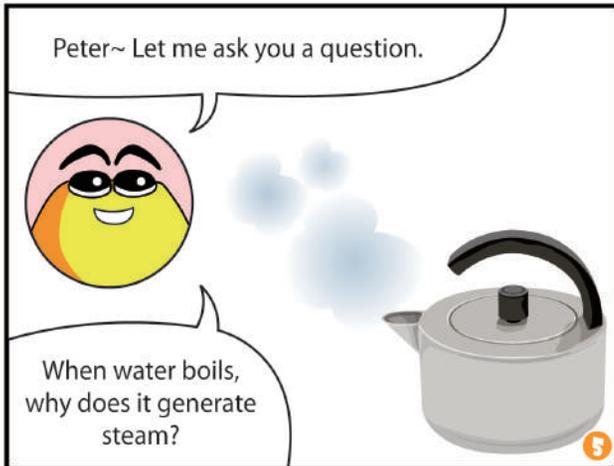
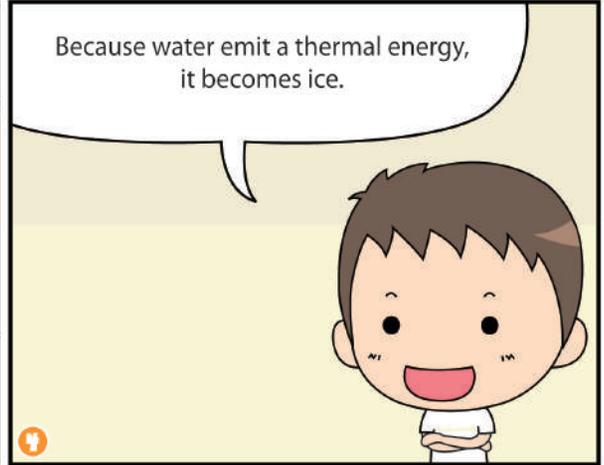
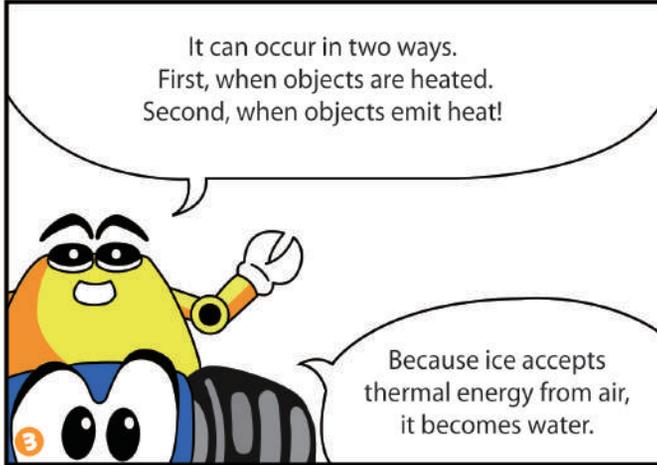
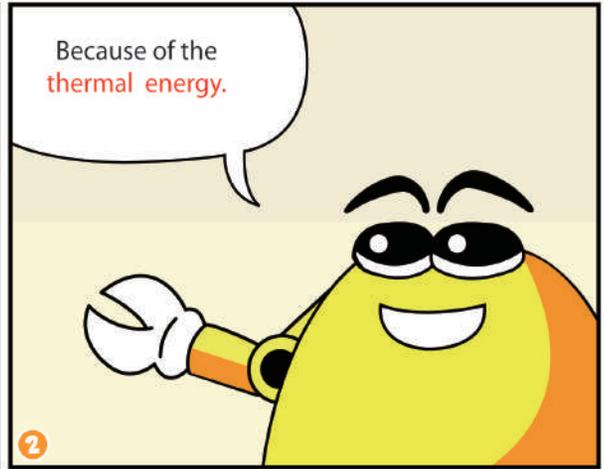
### ★ Warm standby method

This a warm-state stand by method that is able to operate within a few seconds of shutdown.

It's able to perform this function even when the working system has been broken. When this state has been reached, the WSM will be supplied with the necessary energy to operate. When it is converted, the whole reserve system that is operated will be supplied with all of its energy needs.



# My God! Hot! Thermal energy! - Thermal energy



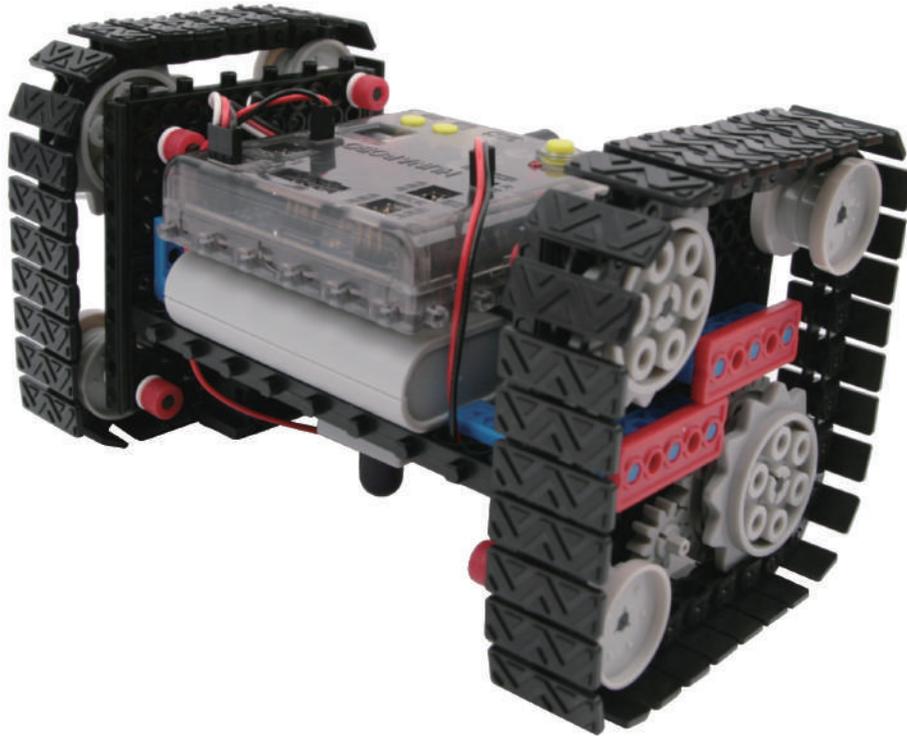


*Making a robot that moves along in all dimensions using caterpillar tracks*



**OFF-ROADER**

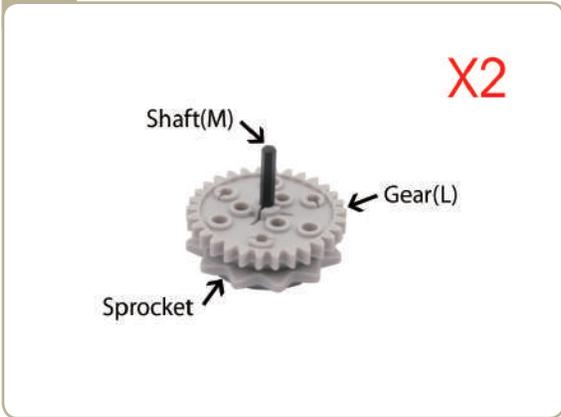
This robot has the ability to move in any dimension and through rough territories. This model can move in any direction and any rough area. Both wheels make use of the caterpillar tracks. If they meet difficult obstacles, it'll go over them. The caterpillar tracks make it possible.



*Prepare parts for assembly*

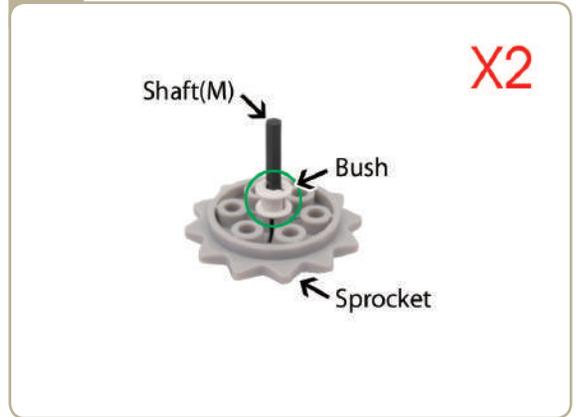
	Block1117	x1		Frame5	x4	
				Adapter2	x6	
				L Adapter	x4	
	Block511	x4		Shaft(M)	x8	
				Half Bush	x8	
	Block15	x4		Bush	x6	
	Block35	x2		Red Bush	x8	
	Caterpillar Track	x66		Gear(S)	x2	RC Receiver x1
	Guide Wheel	x4		Gear(L)	x2	
	DC Motor	x2		Sprocket	x4	

1



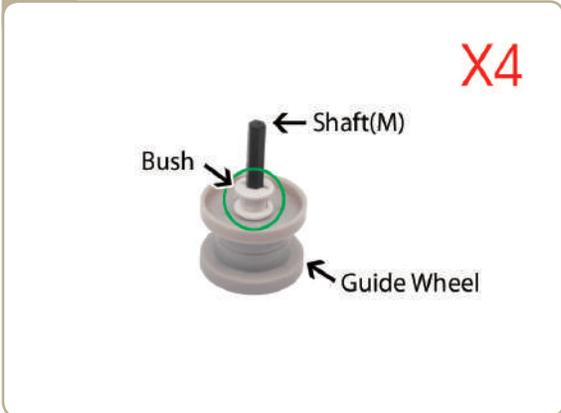
Assemble two identical models.

2



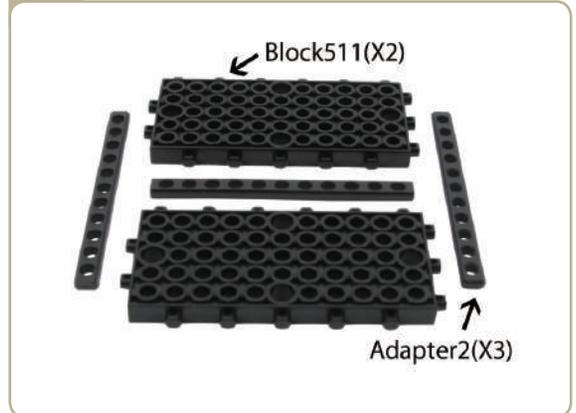
Assemble two identical models.

3



Assemble four identical models.

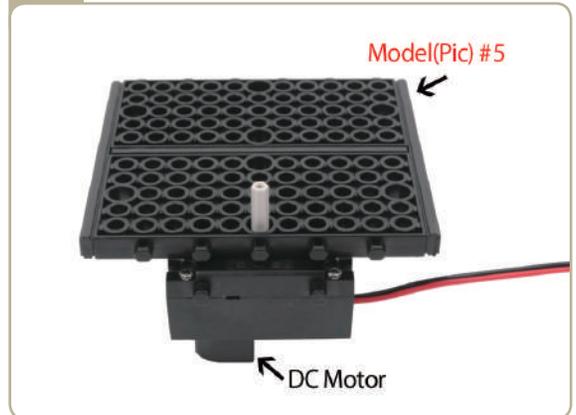
4



5



6

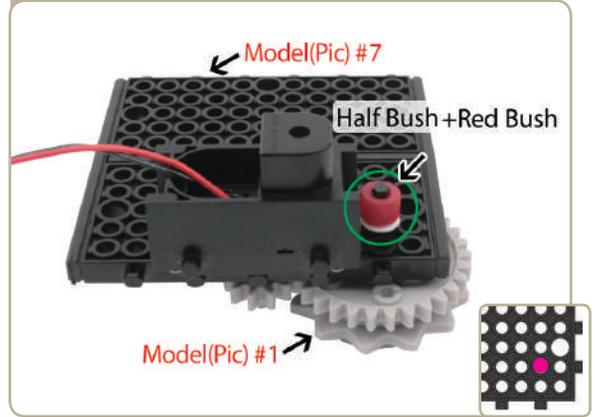


9. What do we call the phenomenon when substances change directly to gas-like state if it is heated without changing from solid to liquid first?

7

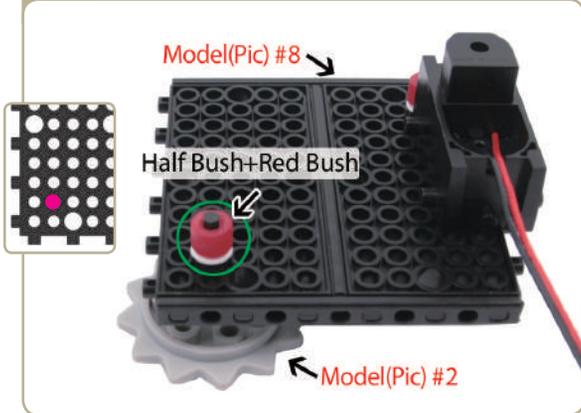


8 ( Bottom of model(Pic)#7 )



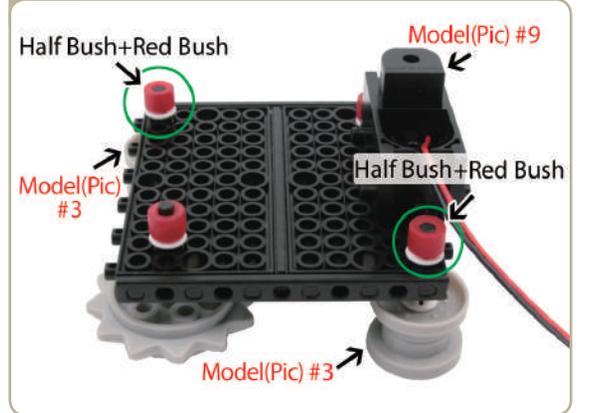
Turn model(pic)#7 upside down, connect a previously constructed part of model(pic)#1 to it with a half bush and a red bush.

9



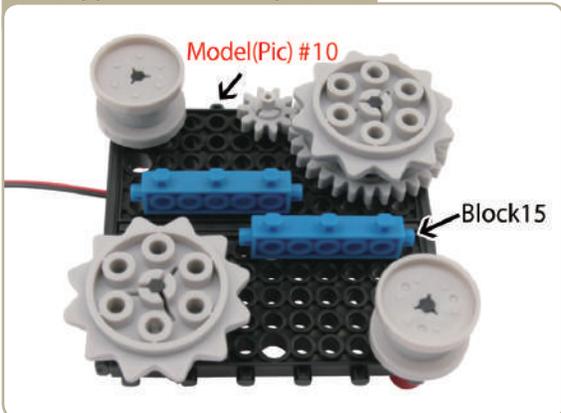
Turn model(pic)#8 to the right side by 90 degrees, connect a previously constructed part of model(pic)#2 to it with a half bush and a red bush.

10



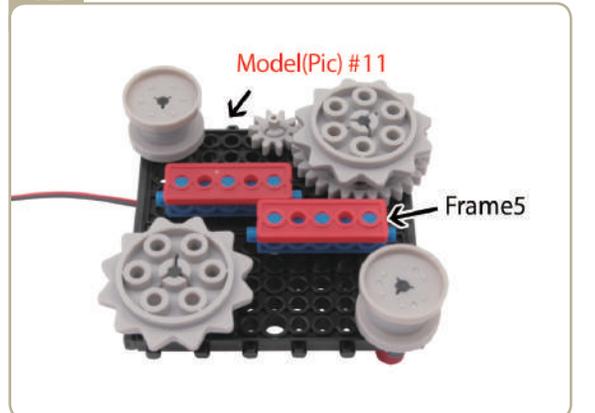
Connect two previously constructed parts of model(pic)#3 to model(pic)#9 with half bushes and red bushes.

11 ( Opposite of model(pic)#10)

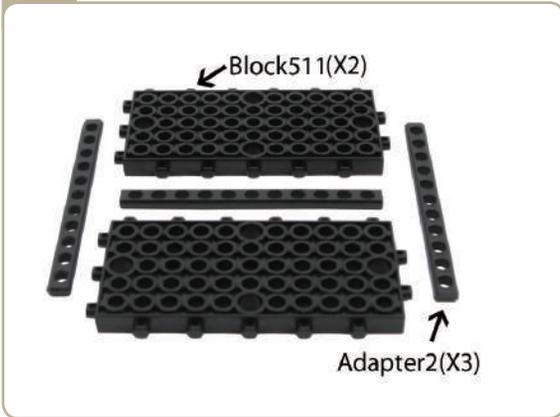


Turn model(pic)#10 upside down, attach two 「block15」s to model(pic)10.

12



13



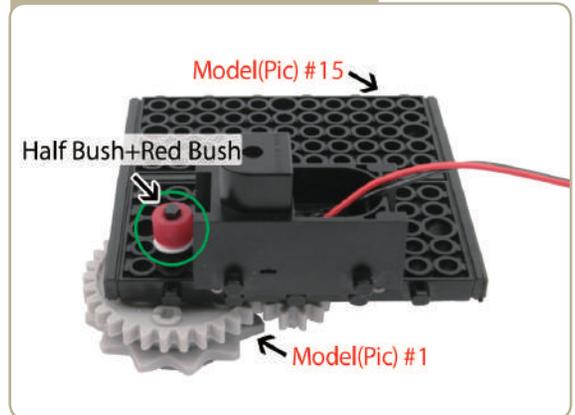
14



15

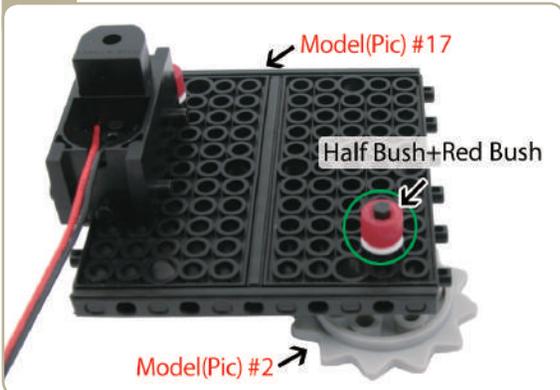


16 ( Bottom of model(Pic)#15 )

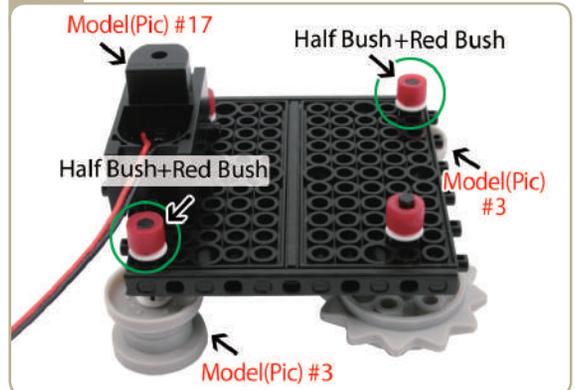


Turn model(pic)#15 upside down, connect a previously constructed part of model(pic)#1 to it with a half bush and a red bush.

17



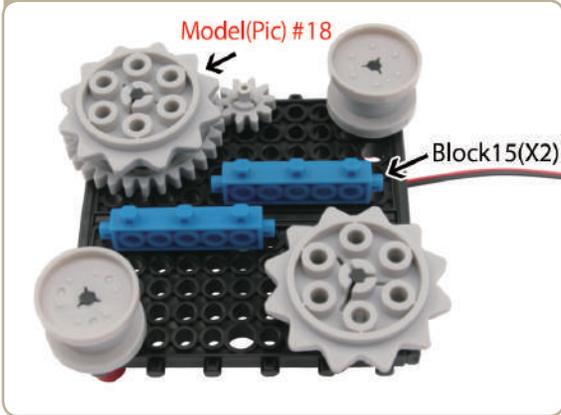
18



Connect two previously constructed parts of model(pic)#3 to model(pic)#17 with half bushes and red bushes.

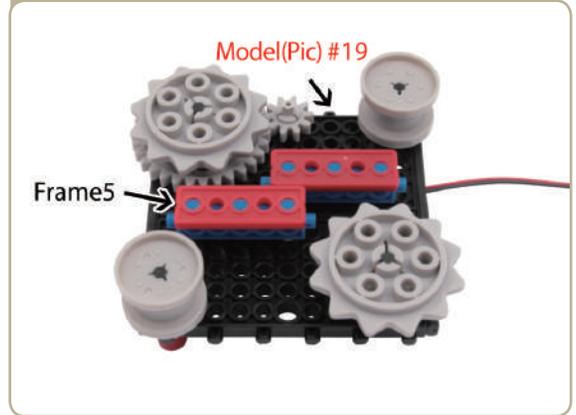
Turn model(pic)#16 to the left side by 90 degrees, connect a previously constructed part of model(pic)#2 to it with a half bush and a red bush.

19 ( Opposite of model(pic)#18)

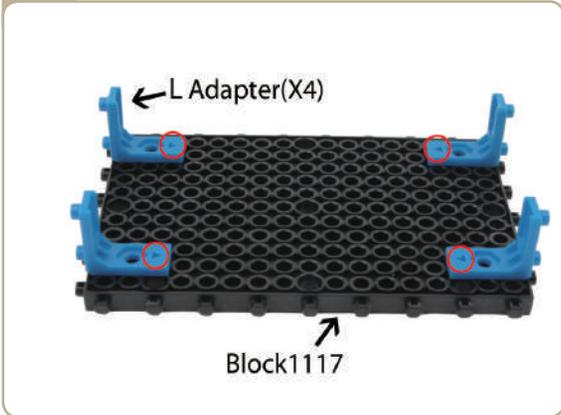


Turn model(pic)#18 upside down, attach two 'block15's to it.

20

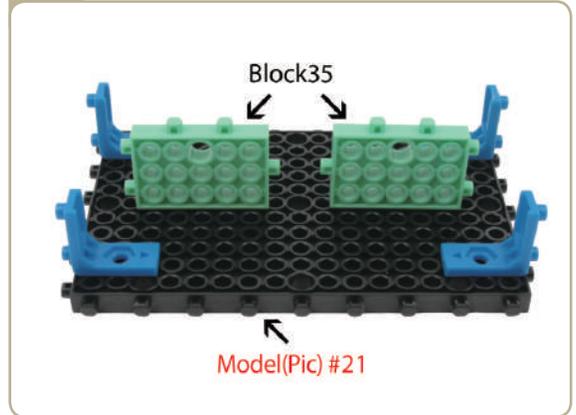


21

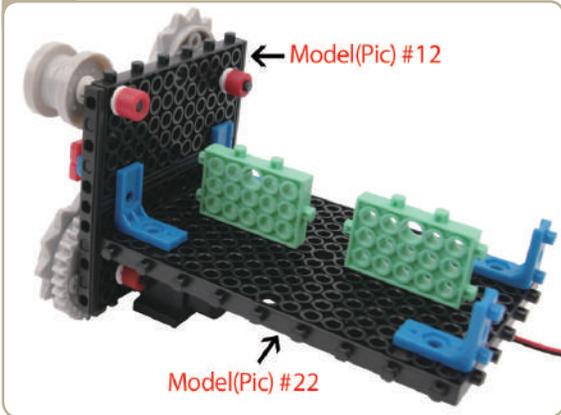


Attach four 'L' adapters to 'block1117'.  
(Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

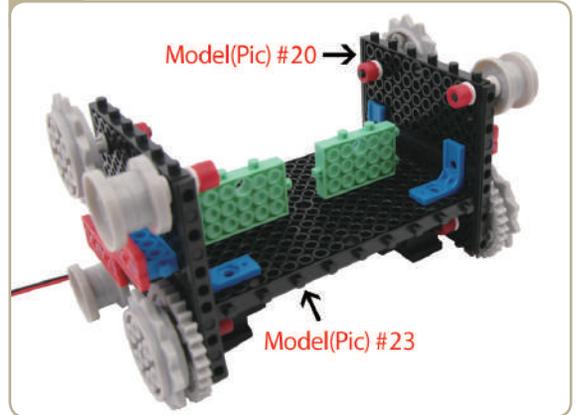
22



23



24

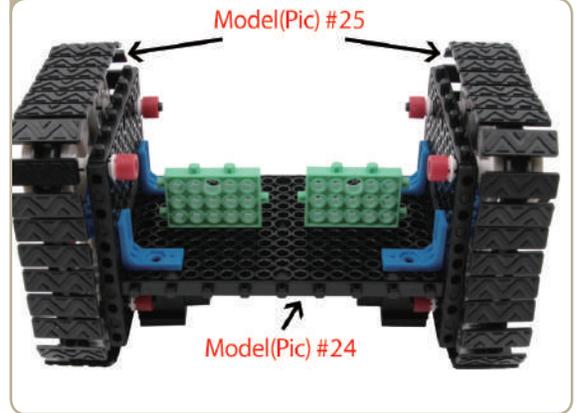


25

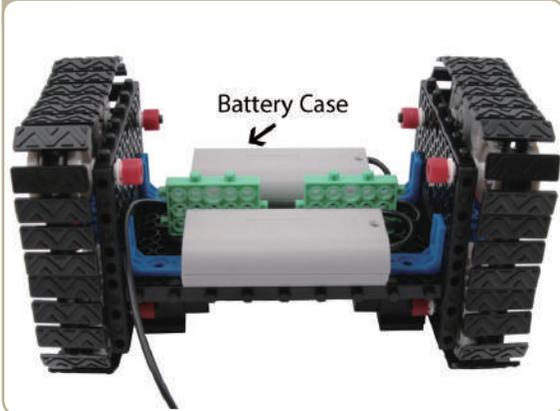


Connect thirty three caterpillar tracks.  
(Assemble two identical models.)

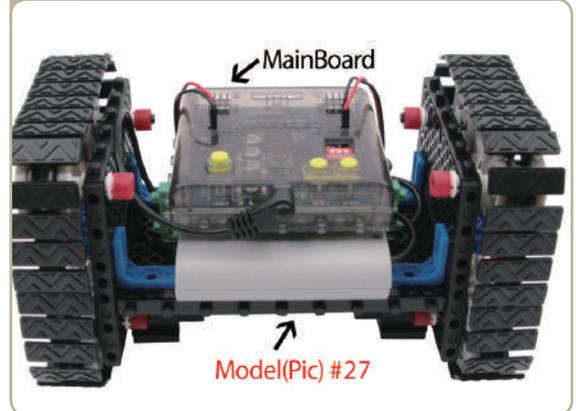
26



27



28



29



Completed

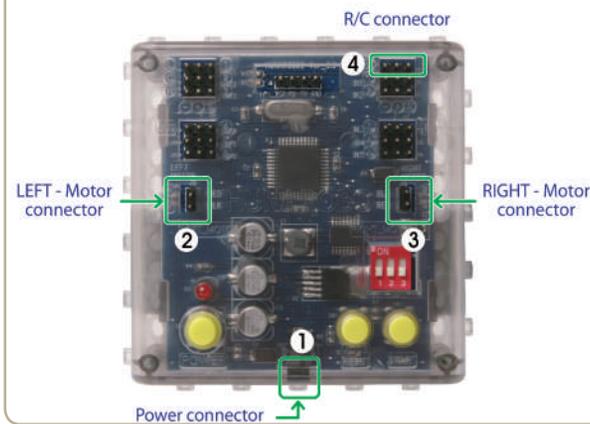


11. What do we call the phenomenon that changes gasses to liquids in colder environments or causes solids to melt?



## How to prepare the OFF-LOADER

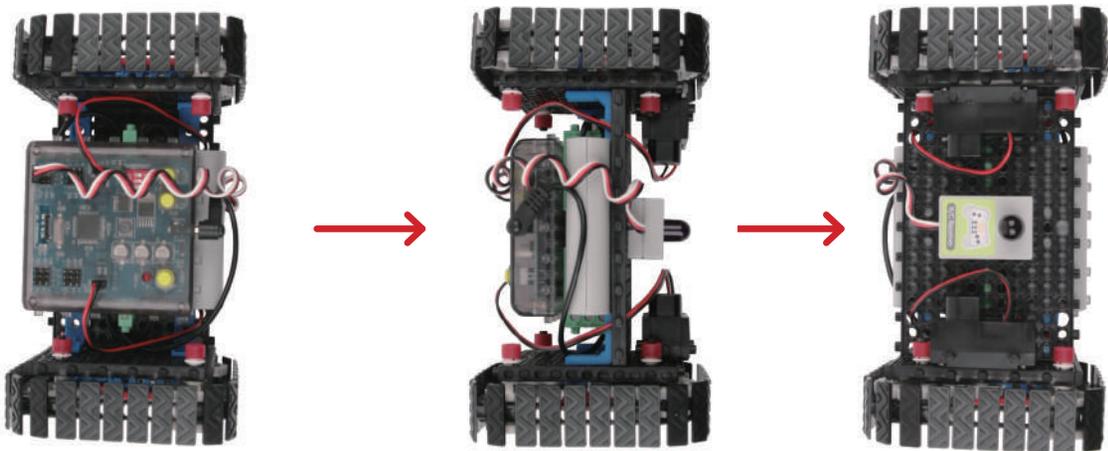
### Connecting the mainboard



### Connect in this order.

1. Connect Battery case 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 to Remote Control connector.

### Motion Pattern



**HINT 1.** Forward/Backward : Make both DC motors move in the same direction.

**HINT 2.** Left/Right turn : Make both DC motors in the different direction.

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

\* For more program examples, visit our reference room. (HunaRobo on our web site, [www.hunarobo.com](http://www.hunarobo.com))

### Program Download

1. Create 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)

\* Refer to 「[HunaRobo Compiler Manual](#)」 on how to create more detailed programs and how to download them.

## Program Example

Action	No
 Program Start	0
 Remocon : [Up] {	1
 DC motor 1 : [Both MOTOR1]=[Backward],[Speed=10]	2
END }	3
 Remocon : [Down] {	4
 DC motor 1 : [Both MOTOR1]=[Forward],[Speed=10]	5
END }	6
 Remocon : [Right] {	7
 DC motor 1 : [L-MOTOR1]=[Backward],[Speed=10]	8
 DC motor 1 : [R-MOTOR1]=[Forward],[Speed=10]	9
END }	10
 Remocon : [Left] {	11
 DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	12
 DC motor 1 : [L-MOTOR1]=[Forward],[Speed=10]	13
END }	14
 Remocon : [Up + Right] {	15
 DC motor 1 : [L-MOTOR1]=[Backward],[Speed=10]	16
 DC motor 1 : [R-MOTOR1]=[Stop]	17
END }	18
 Remocon : [Up + Left] {	19
 DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	20
 DC motor 1 : [L-MOTOR1]=[Stop]	21
END }	22
 Remocon : [Down + Right] {	23
 DC motor 1 : [L-MOTOR1]=[Forward],[Speed=10]	24
 DC motor 1 : [R-MOTOR1]=[Stop]	25
END }	26
 Remocon : [Down + Left] {	27
 DC motor 1 : [R-MOTOR1]=[Forward],[Speed=10]	28
 DC motor 1 : [L-MOTOR1]=[Stop]	29
END }	30
 Remocon : [KEY OFF] {	31
 DC motor 1 : [Both MOTOR1]=[Stop]	32
END }	33
 Program End	34



# How can we use thermal energy?

It's so hot because of the summer!!

In summer, ice is best!!

1

Yeah, ice is great~ Did you know that is made from using a thermal energy?

Really? How does cold ice use a warm thermal energy?

2

Just by emitting heat! Water becomes ice because it emits its heat to colder places.

So, if you want to change a liquid such as water to a solid object such as ice, you need to make it emit heat, then it will start coagulating.

3

Does the process of melting ice use thermal energy as well?

4

Right! In warm places, ice melts because it accepts heat from warmer places. To go from a solid state to a liquid state is called melting.

5

It's amazing! Is there something else?

6

Of course! The gas in the air can become solid as well. In this case, it also emits heat.

What is that?

7

That is 'sublimation'. When a gas changes from a gas to a solid state, it is called sublimation.

Then, of course, gas can change to a liquid state as well. It can even change from liquid to gas.

8

When an object moves from a gas-like state to liquid state with the emission of heat, it is called liquefaction. To go from a liquid to a gas-like state is called evaporation. When water boils, the steam that moves into the air is evaporation.

9



# I feel a twinge! My body is trembling - Electric Energy

**1** Hey, Huna!! It's so dark.

The electricity is out. Let's go find a candle.

**2** How could we have lived without the electricity that makes light shine brightly for us.

It's not the electricity that gives us light, but light energy from the light bulb.

**3** Wow! Are you saying that electric energy finally changes into light energy!

Right! This electric energy can be seen as the power electricity possesses.

**4** In that case, how do they generate electric energy?

**5** Electricity is generated in a power plants.

There are several kinds of power plants. Hydroelectric power plants using water, wind power plants using wind, etc..

**6** Wow~ Peter you studied hard! you did well, so let me tell you something funny?

**7** Fun facts?? Can you tell me more?

Electric energy can be changed into various kind of energy! For instance ,electric energy can change into light energy using a light bulb.

**8** Then... electric energy is magic!

Amazing, right? Let's look for other devices that change electric energy into other kinds of energy.



Making equipment and tool using power of wheel, shaft and motor

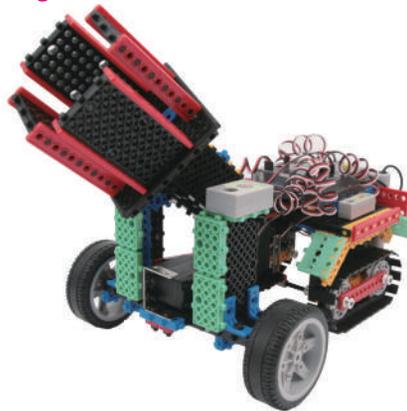


DICE - BOT



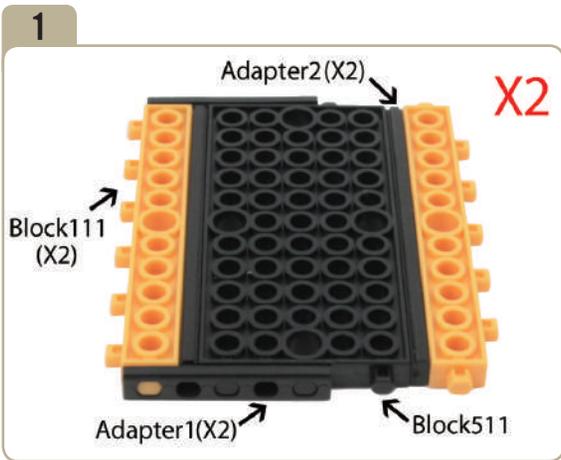
DICE-BOT gets its name from the combination of "Dice" and "Robot". We can play a dice game with this robot. This robot is named after exactly what it does, playing dice! It can also roll the dice while being controlled.

※ After assembling, let's play the dice game with friends.

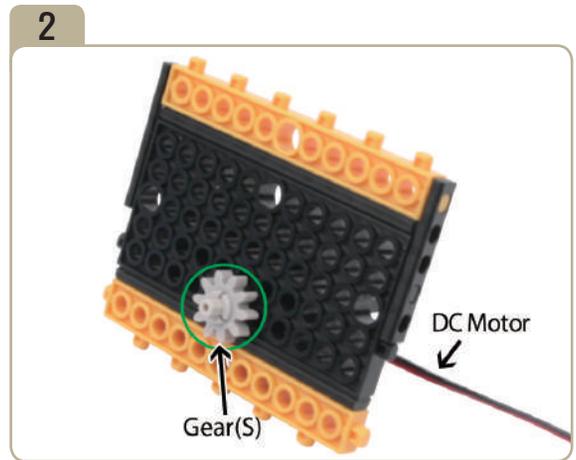


Prepare parts for assembly

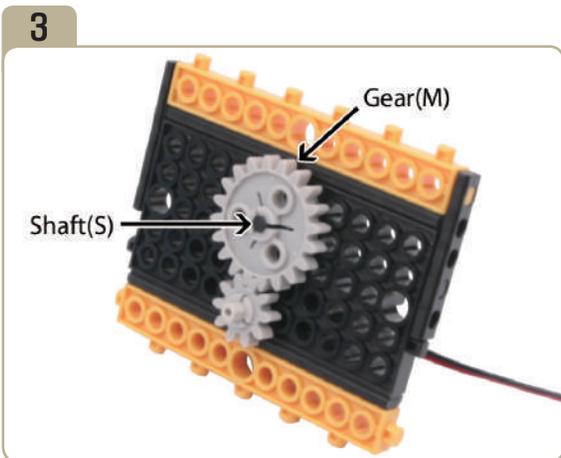
	Block1117	×1		Frame21	×4	
				Frame11	×15	
				Frame5	×2	
				Adapter2	×12	
	Block523	×1		Adapter1	×13	
				L Adapter	×12	
	Block511	×13		Shaft(S)	×4	
				Shaft(M)	×3	
	Block90	×6		Shaft(L)	×5	
	Block135	×4		Half Bush	×4	
	Block15	×8		Bush	×19	
	Block111	×15		Red Bush	×6	
	Block35	×5		Coupling	×2	
	Motor Mount	×7		Gear(S)	×2	
	Wheel Hub(S)	×1		Gear(M)	×1	
	Wheel(L)	×2		Gear(L)	×1	
	Caterpillar Track	×50		Sprocket	×4	
	Servo Motor	×2		Bolt(S)	×8	
				Bolt(M)	×18	
				Nut	×26	



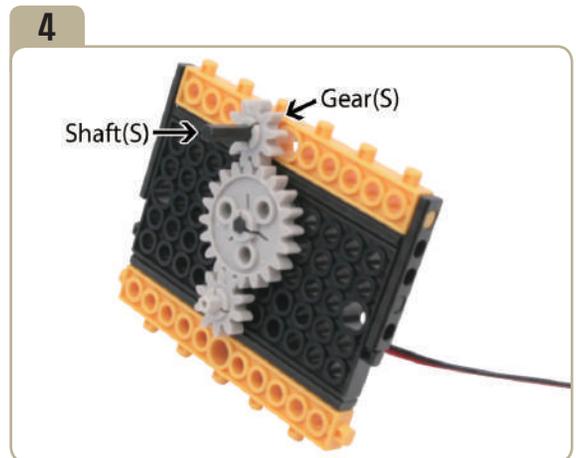
Assemble two identical models.



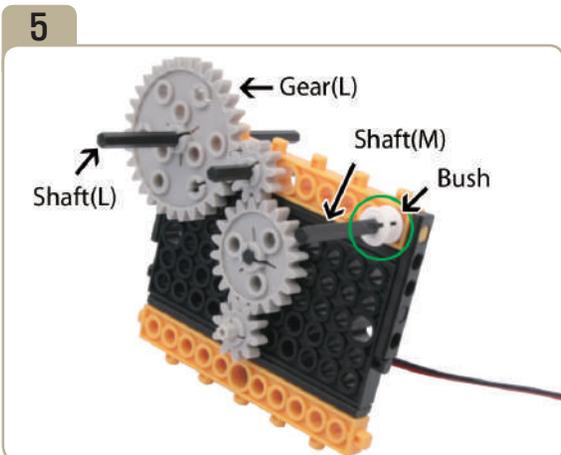
Attach a DC motor to model(pic)#1, then insert a small gear to the shaft of DC motor.



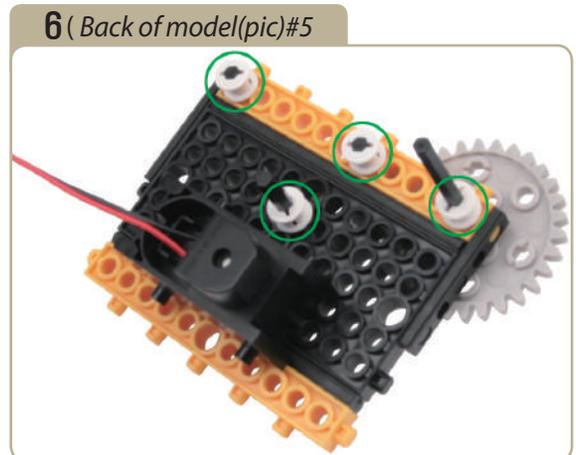
The back side fastens with a bush.



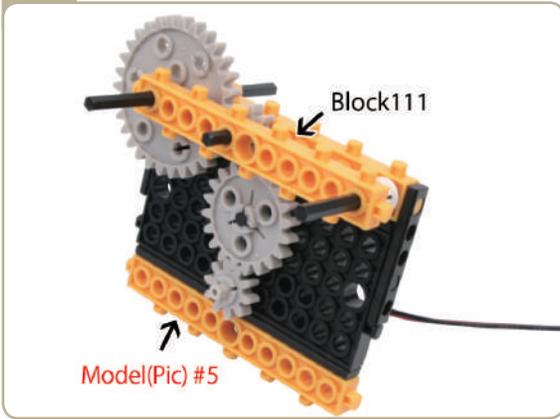
The back side fastens with a bush.



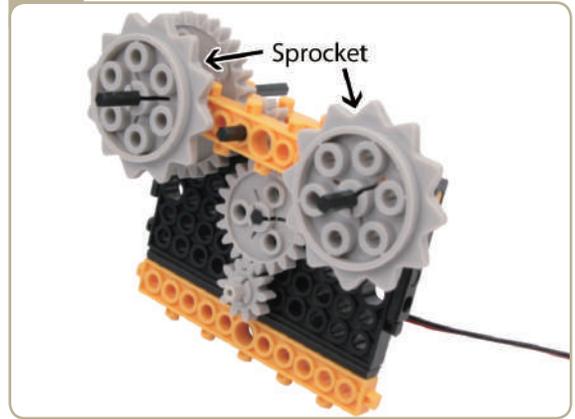
The back side fastens with a bush.



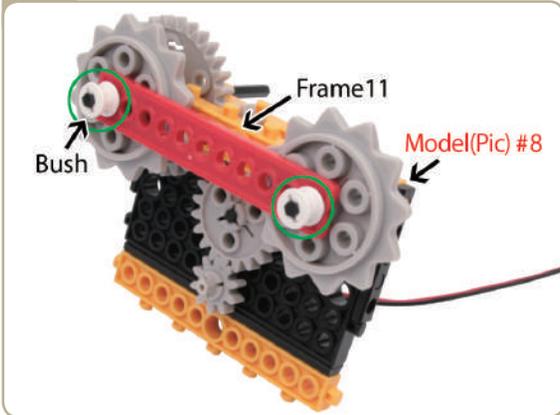
7



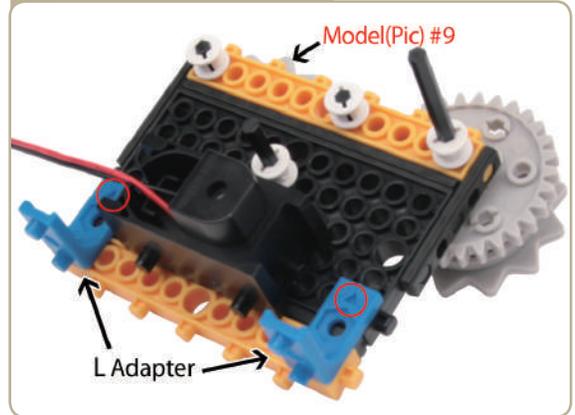
8



9

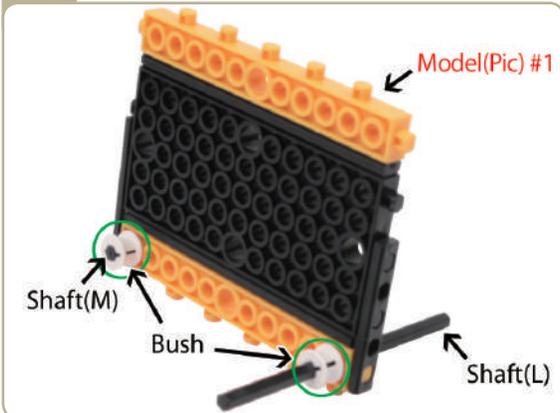


10 ( Back of model(Pic)#9 )

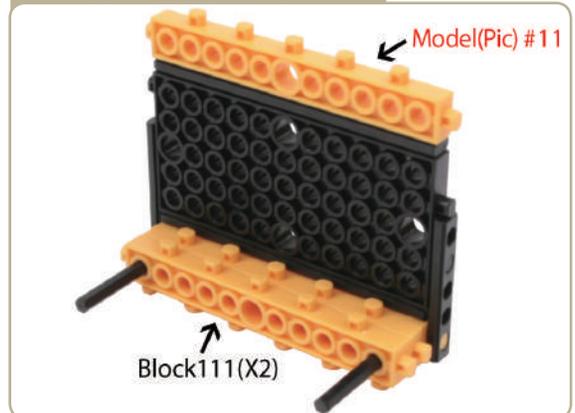


Attach two 'L' adapters to the back of model(pic)#9. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

11

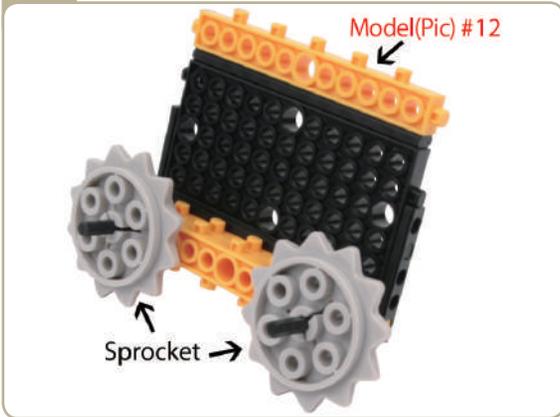


12 ( Opposite of model(pic)#11 )

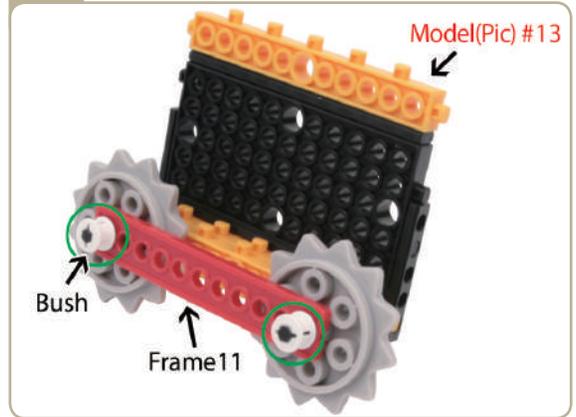


Connect a bush and a long shaft to model(pic)#1, then connect a medium shaft and a bush.

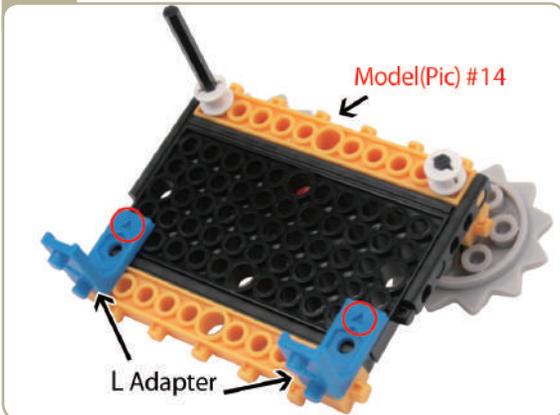
13



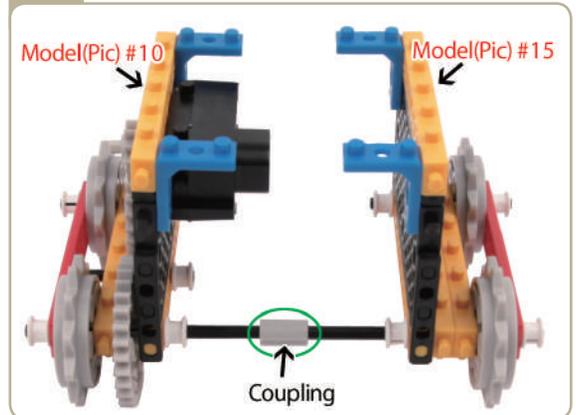
14



15

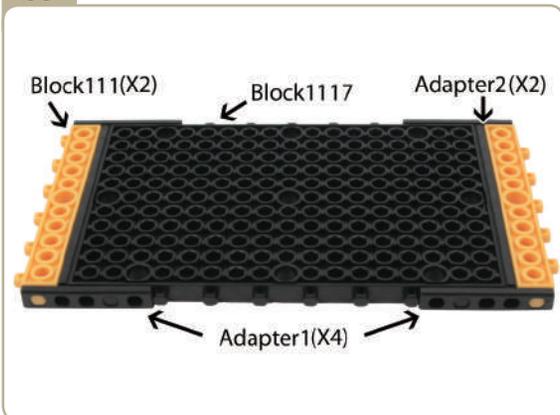


16

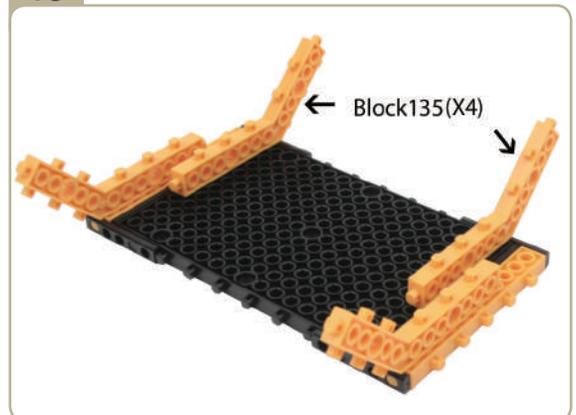


Attach two 'L' adapters to the back of model(pic)#14. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

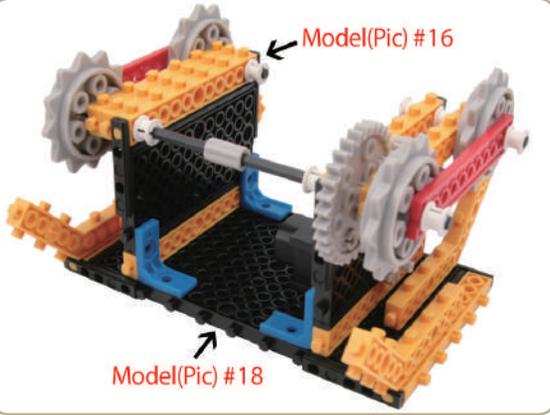
17



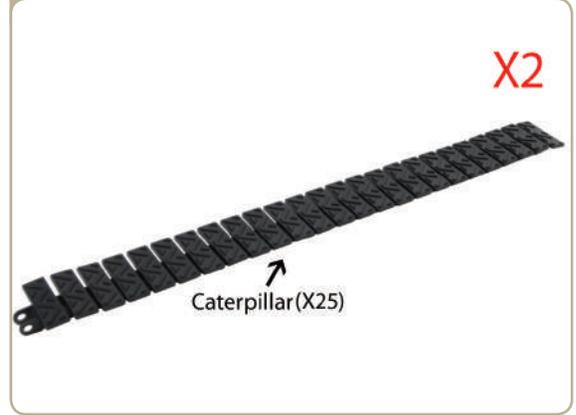
18



19

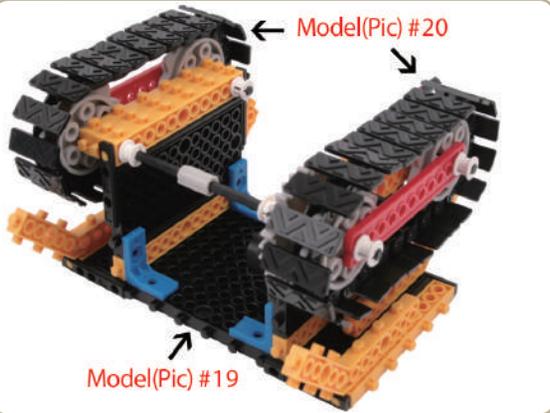


20



Connect twenty five caterpillar tracks.  
(Assemble two identical models.)

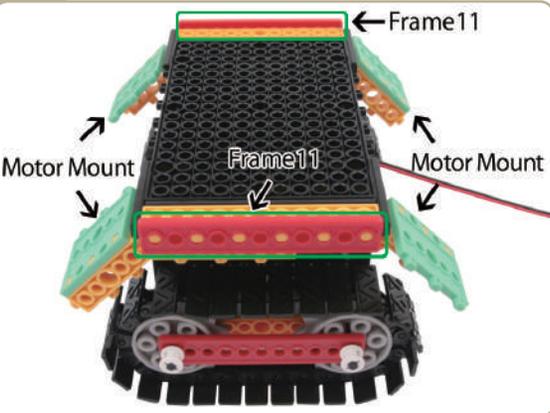
21



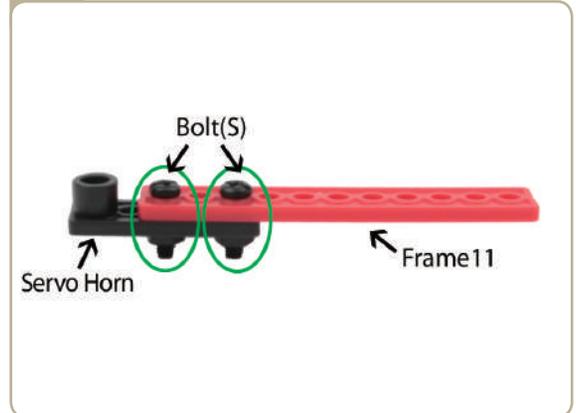
22 ( Opposite of model(pic)#21)



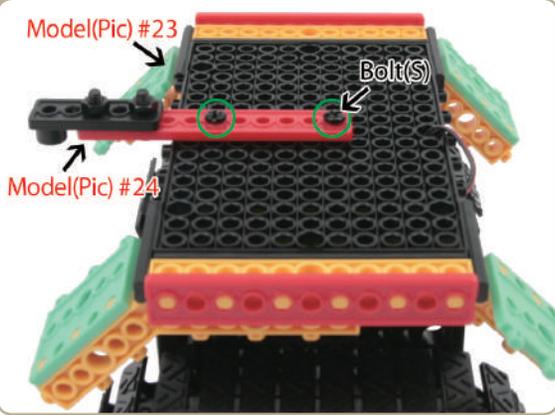
23



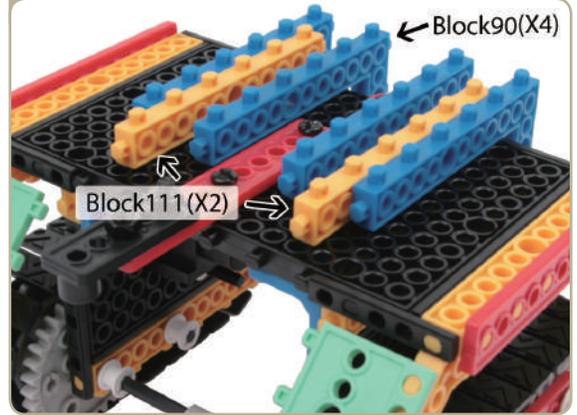
24



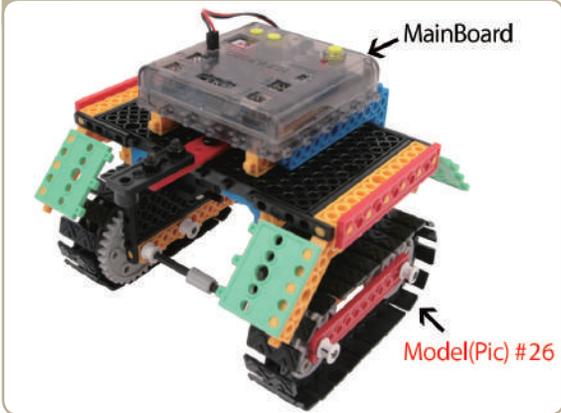
25



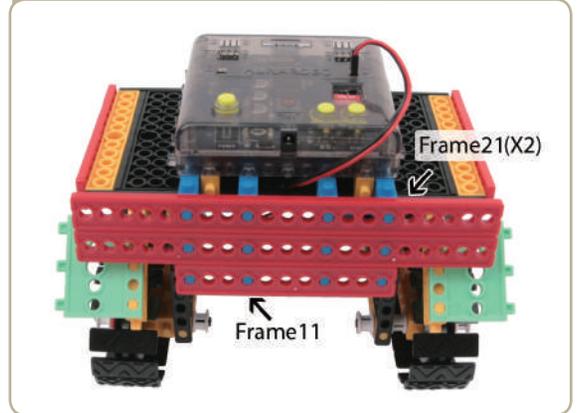
26



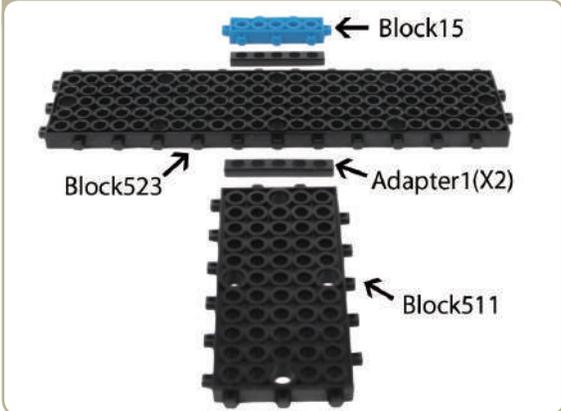
27



28 ( Back of model(pic)#27)



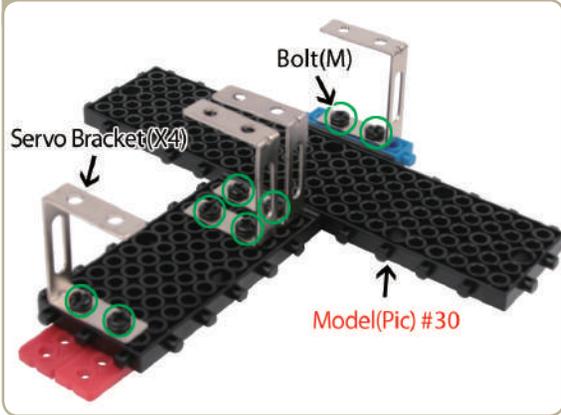
29



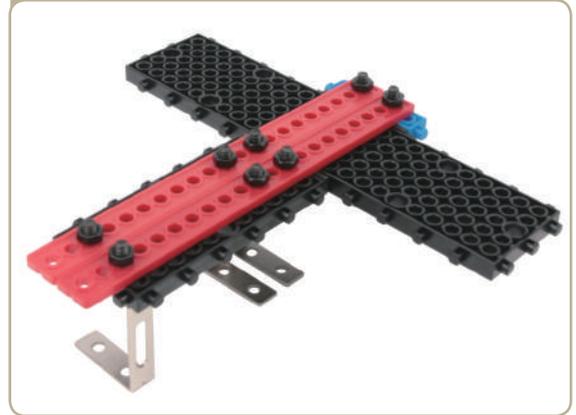
30



31

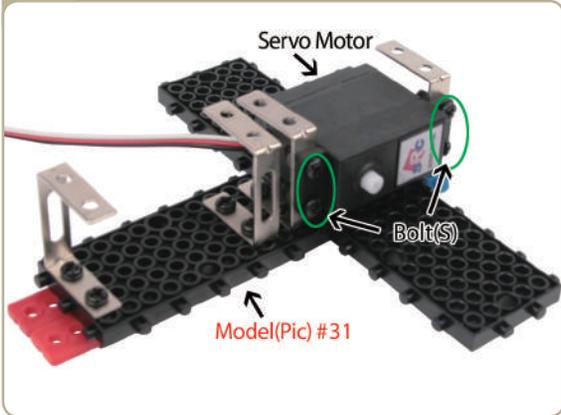


32

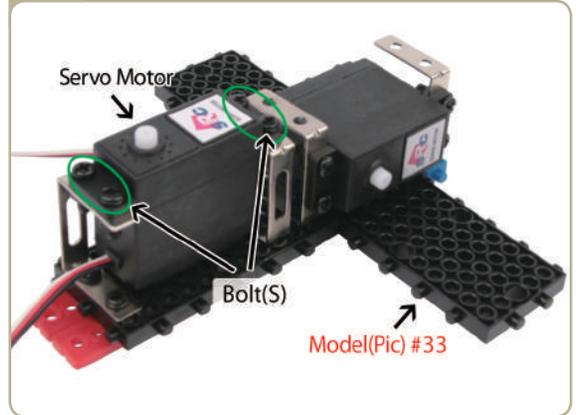


\* A picture in reverse

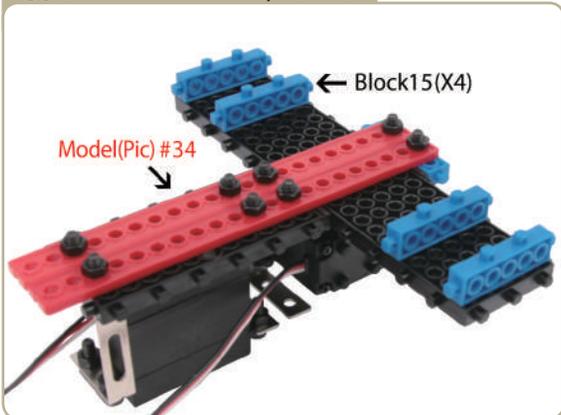
33



34



35 (Bottom of model(pic)#34)

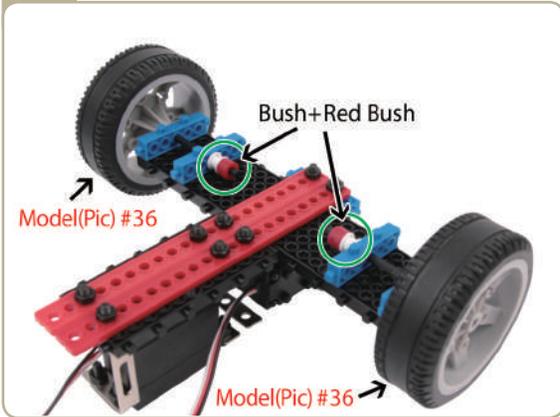


36

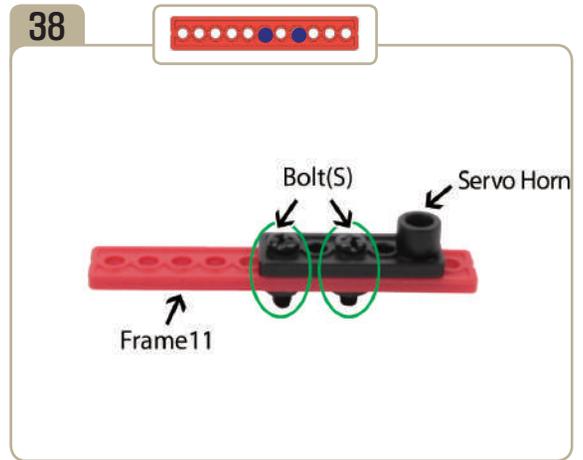


Assemble two identical models.

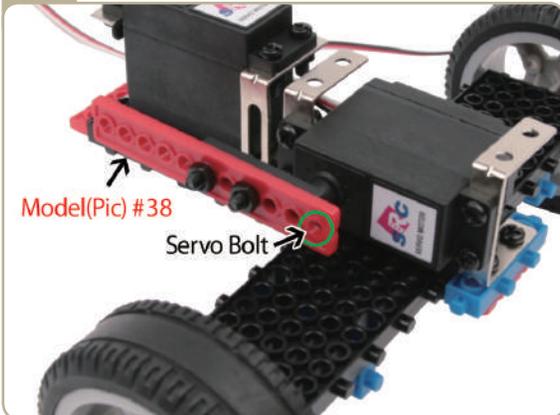
37



38

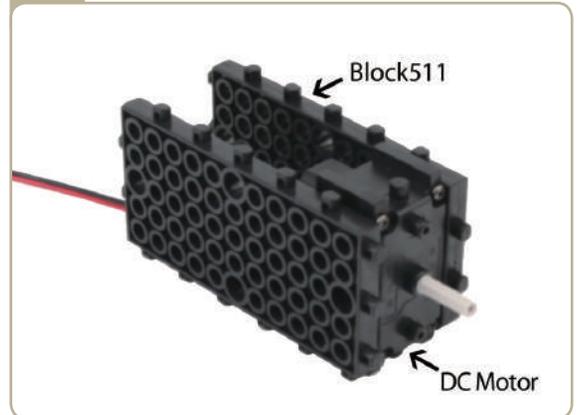


39

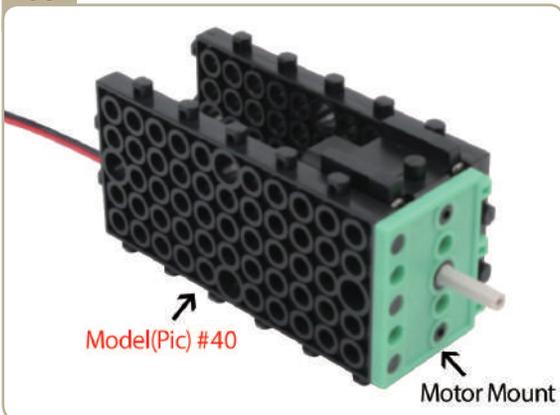


After adjusting zero point of servo motor, fix model(pic)#38 with a small servo bolt.

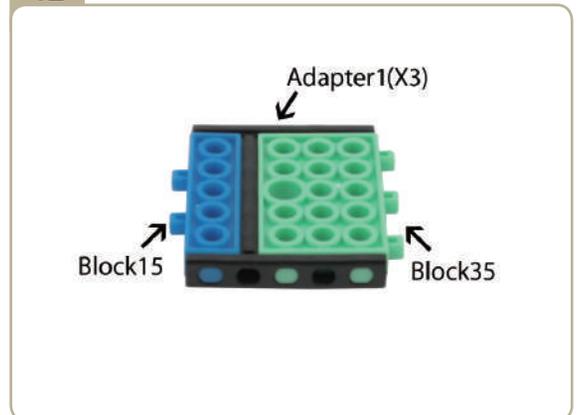
40



41

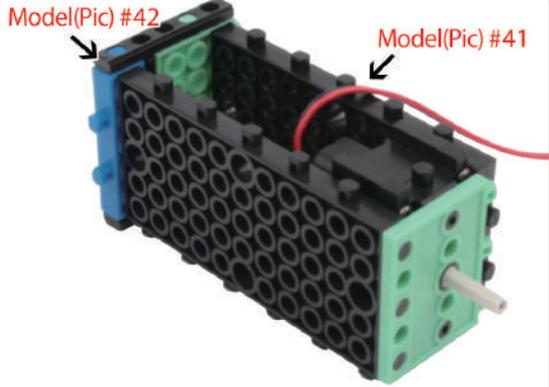


42

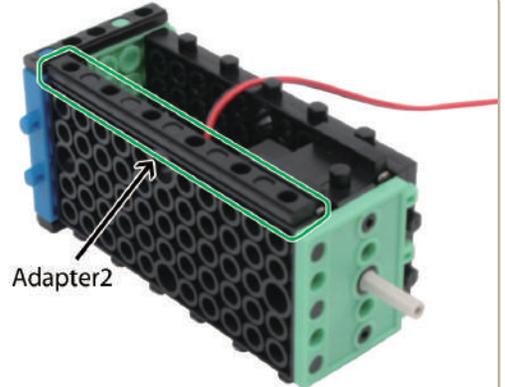


2. What is the name of the part that transmits power and rotation between two shafts?

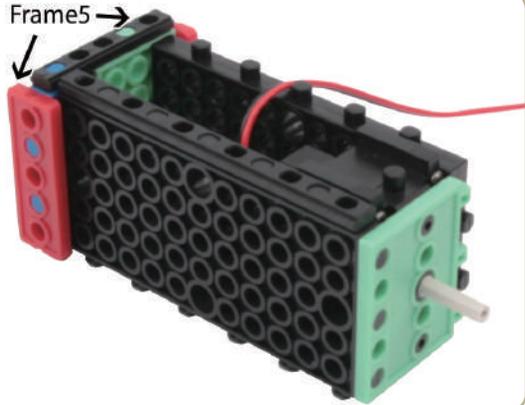
43



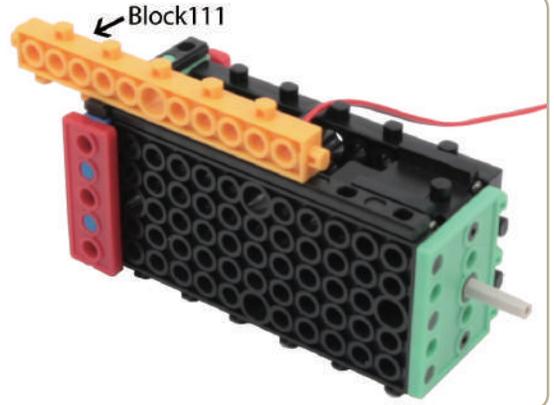
44



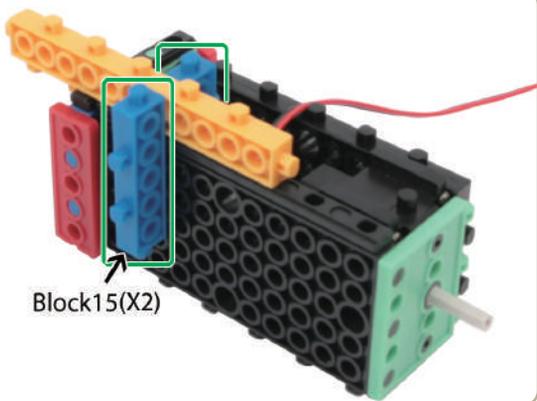
45



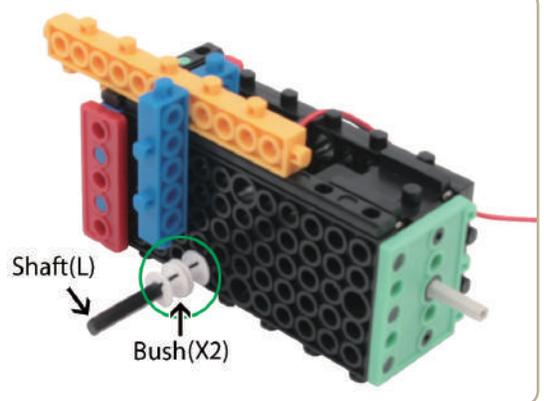
46



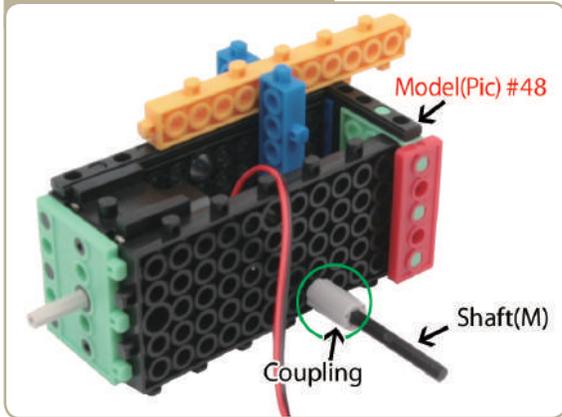
47



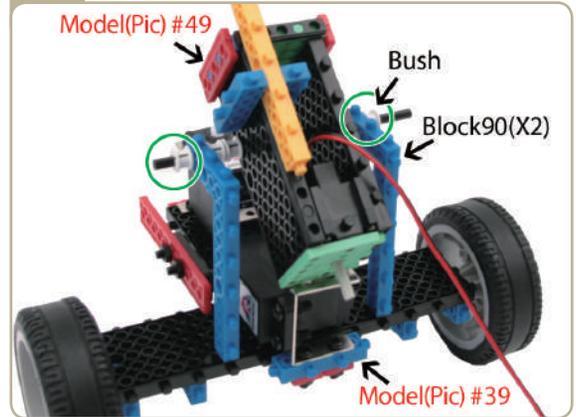
48



49 ( Side of model(Pic)#48 )

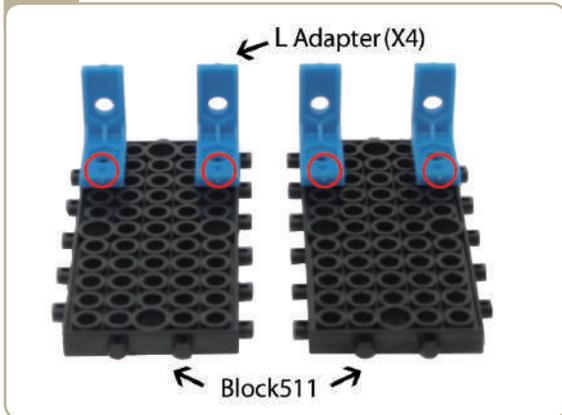


50



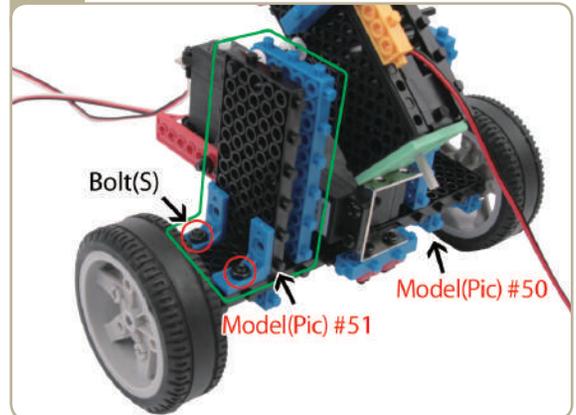
Attach two 「block90」s to model(pic)#39, then connect model(pic)#49 with bushes .

51

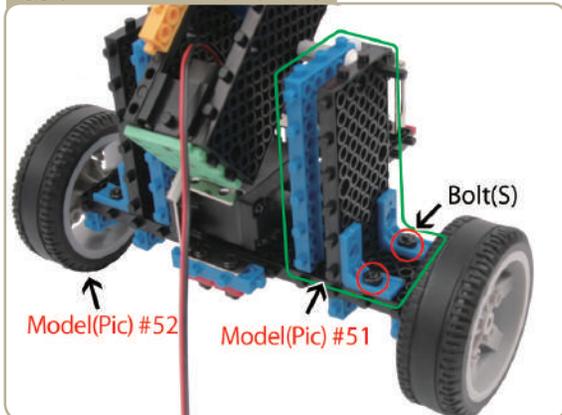


Attach 'L' adapters to 「block511」. (Pay close attention to the arrows(▲) that indicate how the adapters should be attached.)

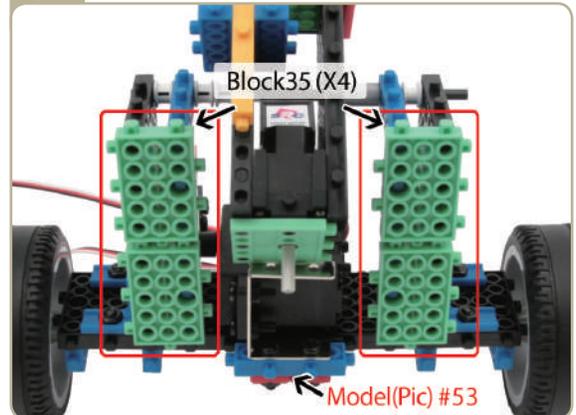
52



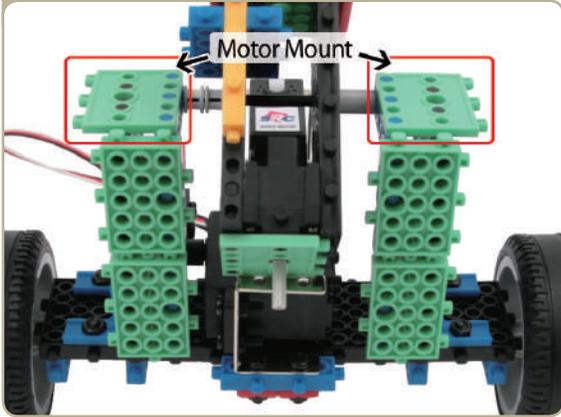
53 ( Side of model(Pic)#52 )



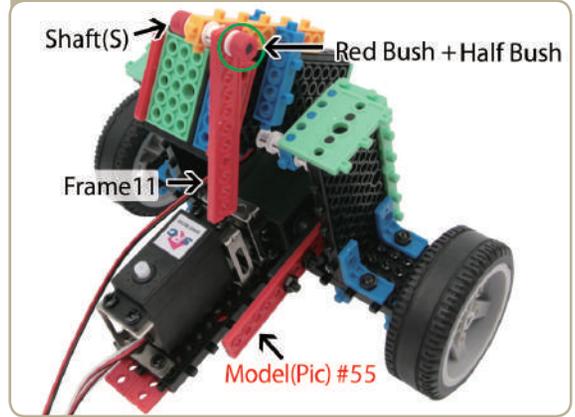
54



55

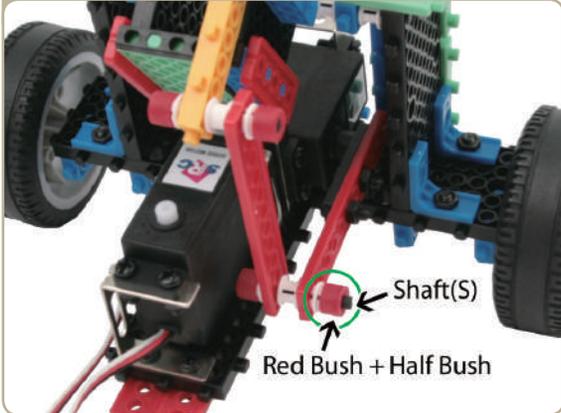


56 ( Back of model(Pic)#55 )



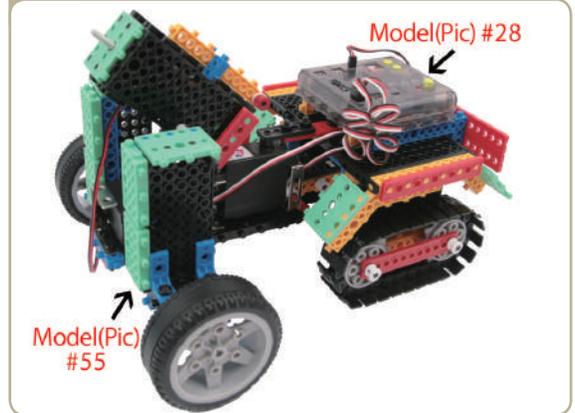
Connect the parts in the following order ;  
 A short shaft → A red bush → A half bush → A bush →  
 A 「frame11」 → A half bush → A red bush.

57



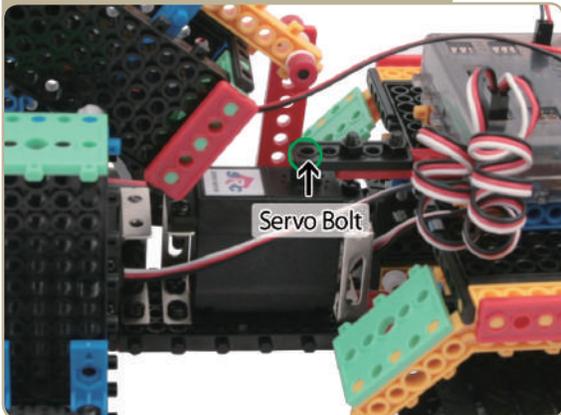
Connect the parts in the following order ;  
 A short shaft → A red bush → A half bush → A bush →  
 → A half bush → A red bush.

58

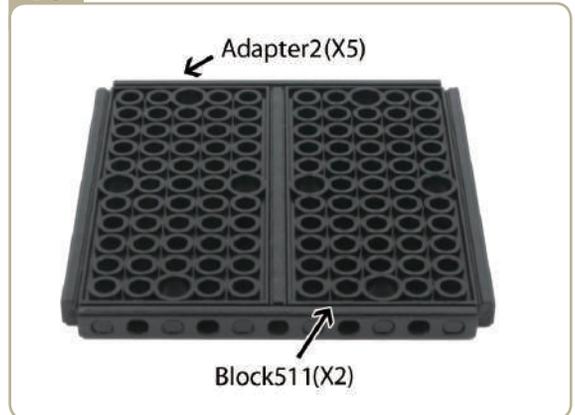


After adjusting zero point of servo motor, fix model(pic)#28 with a small servo bolt.

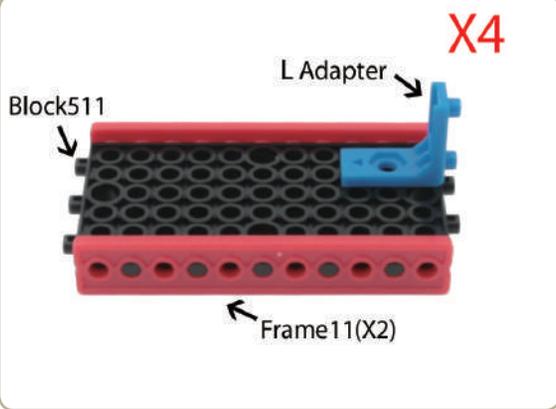
59 ( Enlargement of model(Pic)#58 )



60

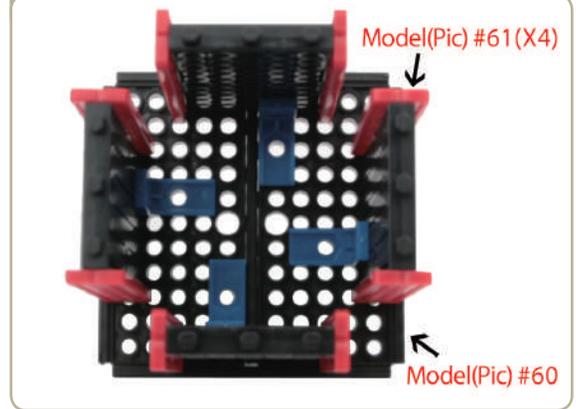


61



Attach two 「frame11」s to 「block511」, then attach a 'L' adapter. Pay close attention to the arrows(▲) that indicate how the adapters should be attached.  
(Assemble four identical models.)

62



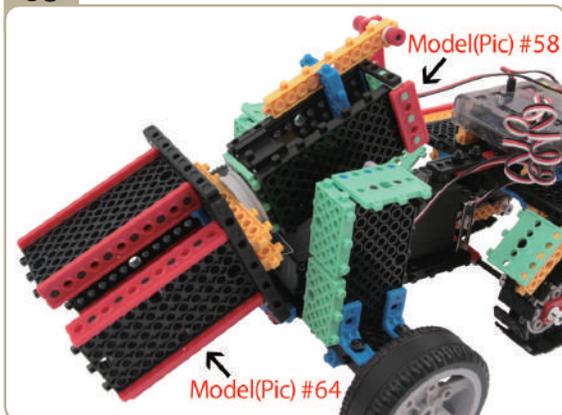
63 (Bottom of model(pic)#62)



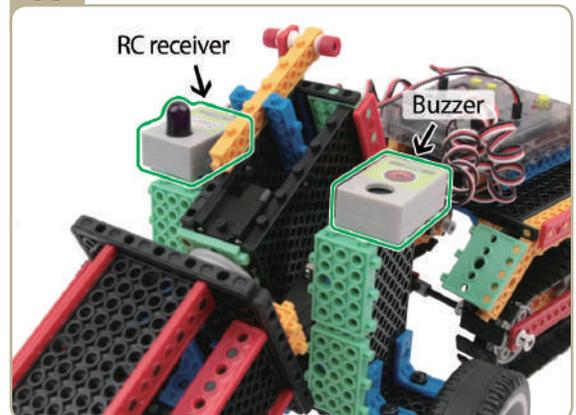
64



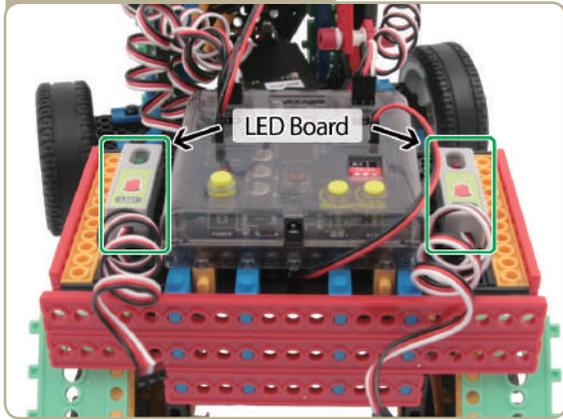
65



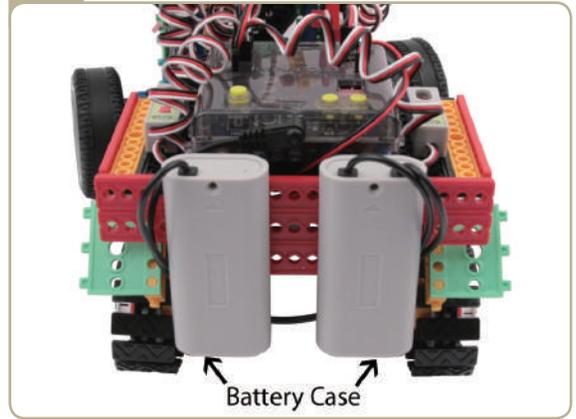
66



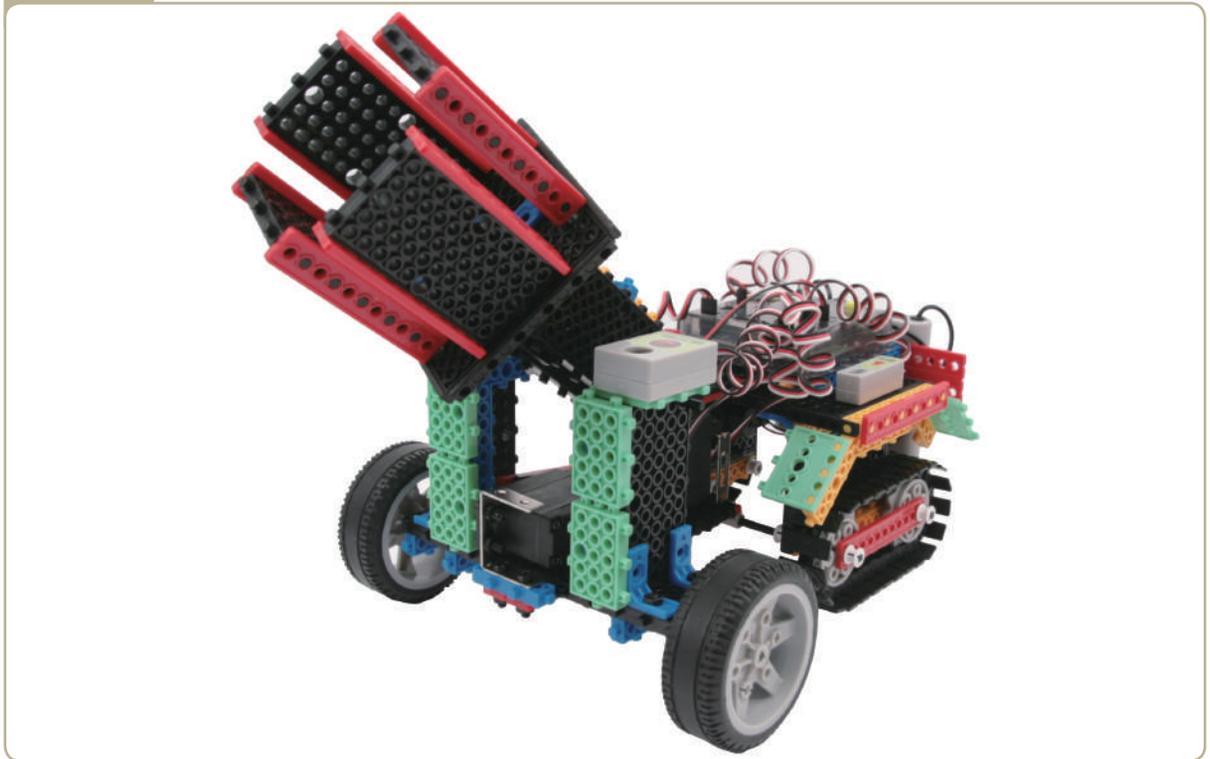
67 ( Back of model(Pic)#66)



68



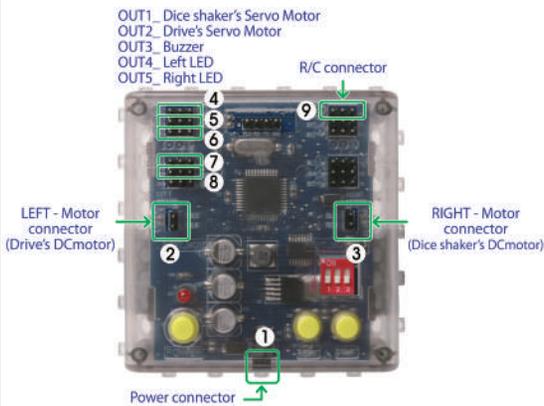
Completed





## How to prepare the DICE-BOT

### Connecting the mainboard



### Connect in this order.

1. Connect Battery case to POWER connector.
2. Connect Drive's DC motor to LEFT- Motor connector.
3. Connect Dice shaker's DC motor to RIGHT-Motor connector.
4. Connect Dice shaker's Servo motor to OUT1 of OUTPUT connector.
5. Connect Drive's Servo motor to OUT2 of OUTPUT connector.
6. Connect Buzzer board to OUT3 of OUTPUT connector.
7. Connect Left LED board to OUT4 of OUTPUT connector.
8. Connect Right LED board to OUT5 of OUTPUT connector.
9. Connect RC receiver to Remote Control connector.

### Motion Pattern



**HINT 1.** Action of forward and backward are made possible with one DC motor.  
Directional changes left and right are made possible with servo motor.

**HINT 2.** It can throw and turn dice with one DC motor and one servomotor. (When throwing dice, buzzer works.)

\* Let's try to make a program that is operable with a remote control.

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

\* For more program examples, visit our reference room. (HunaRobo on our web site, [www.hunarobo.com](http://www.hunarobo.com))

### Program Download

1. Create 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)

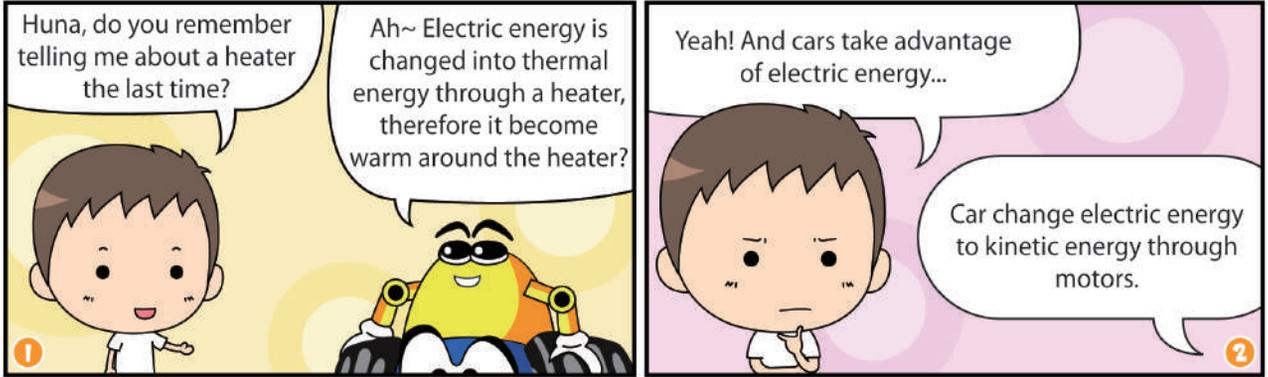
\* Refer to 「[HunaRobo Compiler Manual](#)」 on how to create more detailed programs and how to download them.

## Program Example

Action	No
Program Start	0
Remocon : [Up] {	1
Servo : [OUT1]=[0]	2
DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	3
LED : [OUT4]=[ON], [OUT5]=[ON]	4
END }	5
Remocon : [Down] {	6
Servo : [OUT1]=[0]	7
DC motor 1 : [R-MOTOR1]=[Forward],[Speed=10]	8
END }	9
Remocon : [Up + Right] {	10
Servo : [OUT1]=[-20]	11
DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	12
LED : [OUT5]=[ON]	13
END }	14
Remocon : [Up + Left] {	15
Servo : [OUT1]=[20]	16
DC motor 1 : [R-MOTOR1]=[Backward],[Speed=10]	17
LED : [OUT4]=[ON]	18
END }	19
Remocon : [Down + Right] {	20
Servo : [OUT1]=[-20]	21
DC motor 1 : [R-MOTOR1]=[Forward],[Speed=10]	22
END }	23
Remocon : [Down + Left] {	24
Servo : [OUT1]=[20]	25
DC motor 1 : [R-MOTOR1]=[Forward],[Speed=10]	26
END }	27
Remocon : [F1] {	28
DC motor 1 : [L-MOTOR1]=[Backward],[Speed=10]	29
Servo : [OUT2]=[-20]	30
Buzzer : [OUT3]=[ON]	31
Delay : [2 sec]	32
DC motor 1 : [L-MOTOR1]=[Stop]	33
Buzzer : [OUT3]=[OFF]	34
Servo : [OUT2]=[30]	35
Delay : [2 sec]	36
END }	37
Remocon : [KEY OFF] {	38
DC motor 1 : [R-MOTOR1]=[Stop]	39
LED : [OUT4]=[OFF], [OUT5]=[OFF]	40
END }	41
Servo : [OUT2]=[0]	42
Program End	43



## A transformation magician - Electric Energy



**Go and take a look at things that changes electric energy to other kinds of energy.**



A large, light blue rectangular area with horizontal dashed lines, intended for writing notes.

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