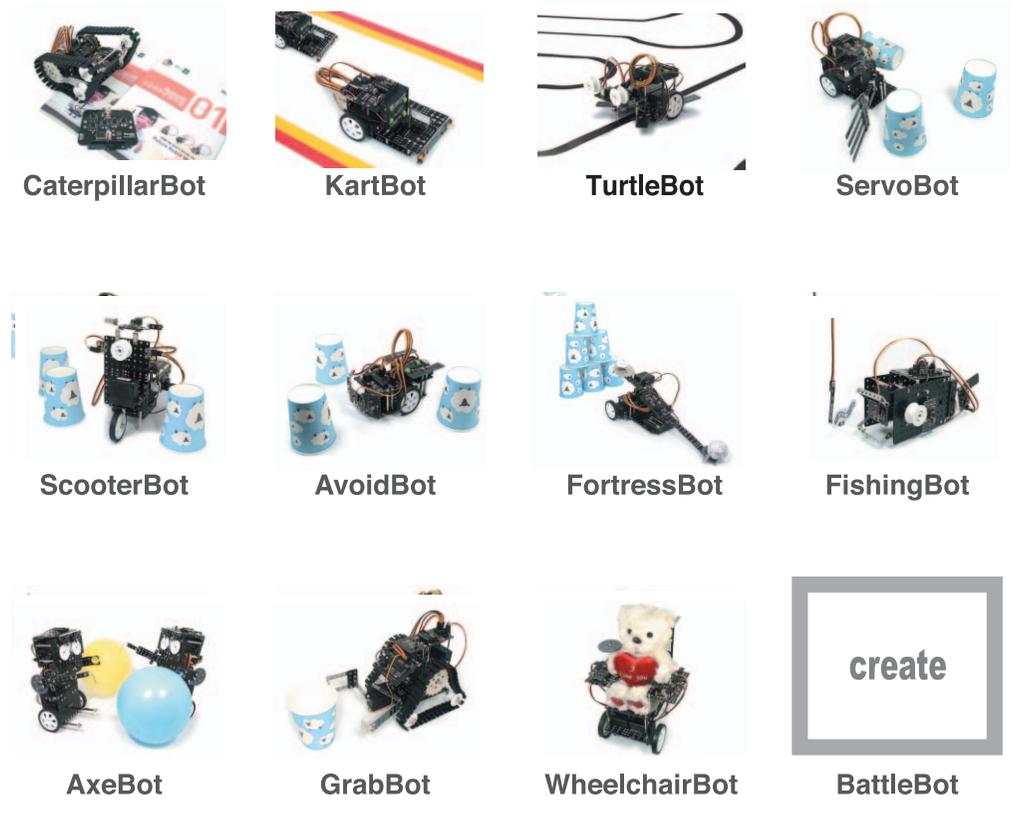


# The world for prospective scientists, who will lead the future Future Robot World



RoboRobo is striving to nourish students with scientific ability who will lead the 21st century. For this reason, we have adapted the robotic education model of advanced countries, and have systemized the educational curriculum and learning tool which is designed by the best brains of the best university.



Robot Education Research Group of Engineering doctors of Seoul National University  
**Research Society for Education of Intelligent Robot**



Research Society for Education of Intelligent Robot



Intelligent Robot School 02

## ROBOROBO Intelligent Robot School

# 021

Step



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**ROBOROBO**  
**Intelligent  
Robot School**

Step  
**021**



The world for prospective scientists,  
who will lead the future

**Future Robot World**



Robot Education Research Group of Engineering doctors of Seoul National University  
**Research Society for Education of Intelligent Robot**

## PRECAUTION

- 1 Do not put the parts in your mouth.
- 2 Do not operate or bend/ remove the parts forcibly.
- 3 Do not put your hand of moving parts.
- 4 Do not throw or swing components or products to people.
- 5 Be careful when touching sharp edge of the parts.
- 6 Keep away from flammable or corrosive solvents (including water)\* and gases.
- 7 Do not expose to water or any other corrosive liquid.
- 8 If the chemical from a battery gets into your eyes, mouth, or on your skin, follow the instructions below.
  - If the chemical gets into your eyes : Flush them thoroughly with clean water, and then see a doctor immediately.
  - If the chemical gets into your mouth : If swallowed, do not induce vomiting. See a doctor immediately. : If the chemical just gets into your mouth, wash out your mouth with water thoroughly.
  - If the chemical gets on your skin : Wash the area thoroughly with soap and water.

## Intelligent Robot School 02

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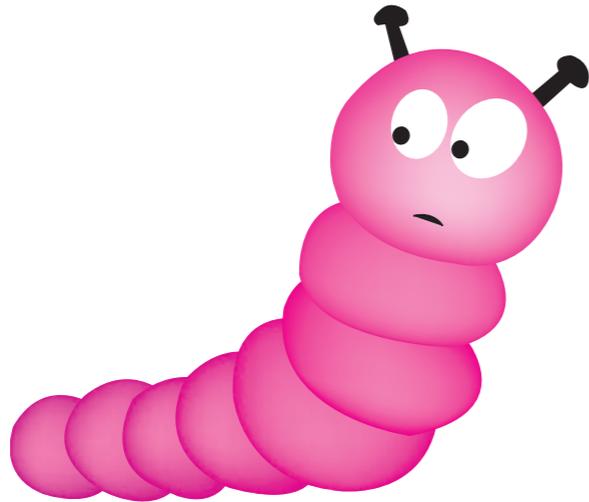
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**CaterpillarBot** is a robot that can pass the bumpy road by using caterpillar. Learn the specific features of caterpillar that is used in tanks or bulldozers and try to operate the caterpillarbot by a remote control.

- ▶ Caterpillar : an endless track
- ▶ Tank : a large military vehicle that is equipped with weapons and moves along on metal tracks that are fitted over the wheels.
- ▶ Bulldozer : a large vehicle with a broad metal blade at the front, which is used for knocking down buildings or moving large amounts of earth.

## • • • Caterpillar • • •



Caterpillar is the representative word of tank's endless track. Caterpillar is a word actually meaning a larva of a butterfly or moth and it is named as the motion of tank's endless track is similar to that of a larva's legs in order.

Caterpillar has larger ground area than wheels and has large friction with ground so it has disadvantage of slow speed than the wheels and makes lots of noise in general. However, it has been used as construction equipment like an excavator and a bulldozer, military equipment like tanks and an armored car with an advantage of ability on the bumpy uneven dirt road or the rough and difficult ground.



〈M-2 Bradley War on Wheels〉



〈Bulldozer〉

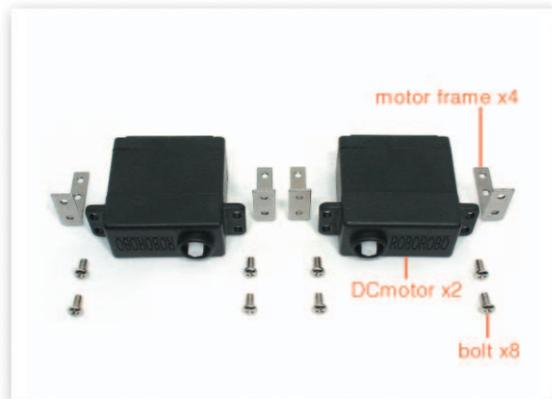
Also, it is free to change direction by changing the rotation speed of left and right and can minimize the radius of rotation. Namely, if rotate the both caterpillars in a same speed as they oppose, the center of a vehicle can rotate on an original place as not moving a bit.

Now, make diversely structured robots by using the specifics of caterpillar well and make your robot run on a bumpy road.

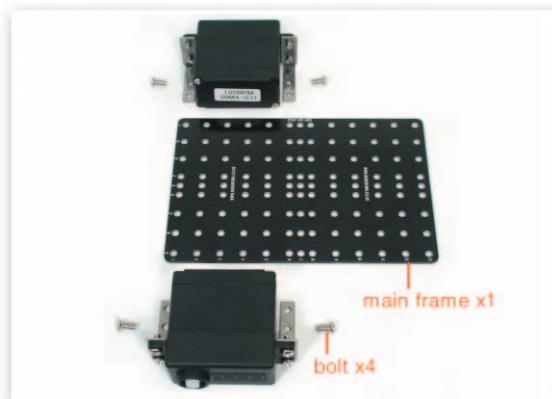


# How to Assemble

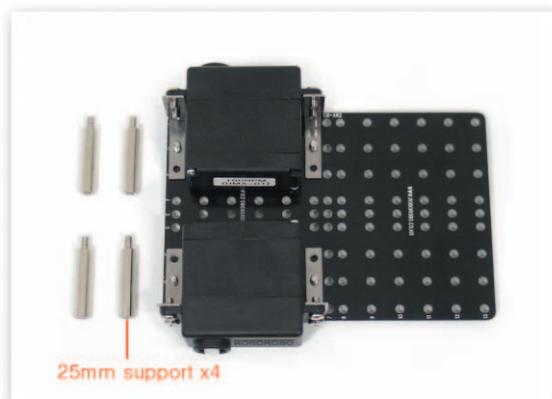
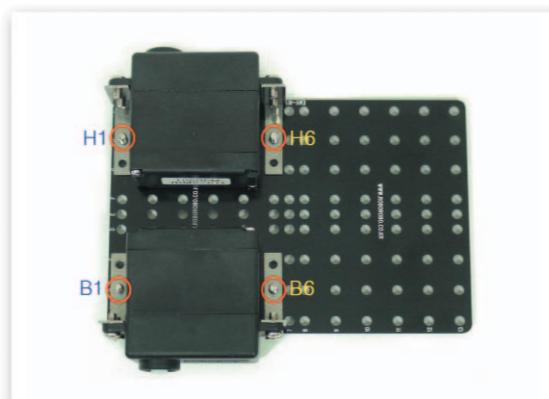
# CaterpillarBot



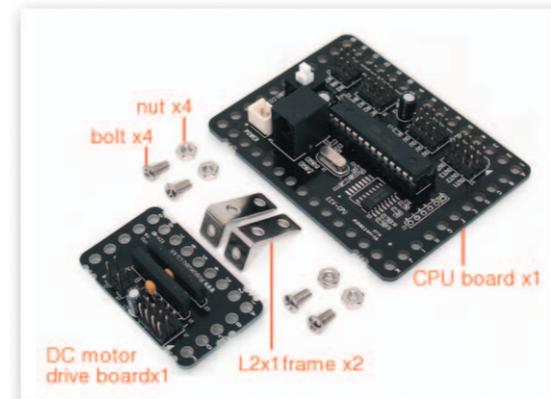
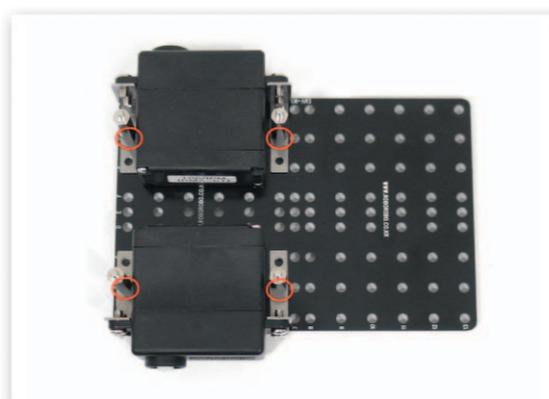
1 Fix DC Motor and Motor Frame only using bolts. ( with attention to the direction of the Motor Frame)



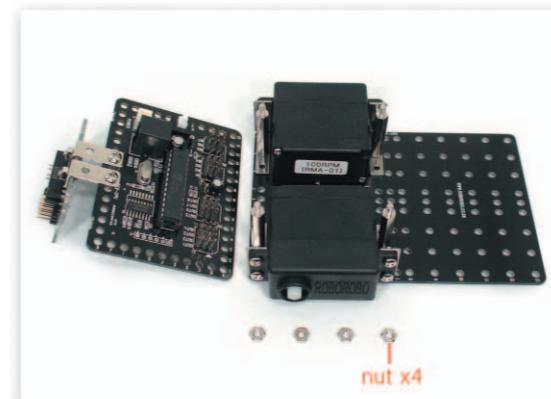
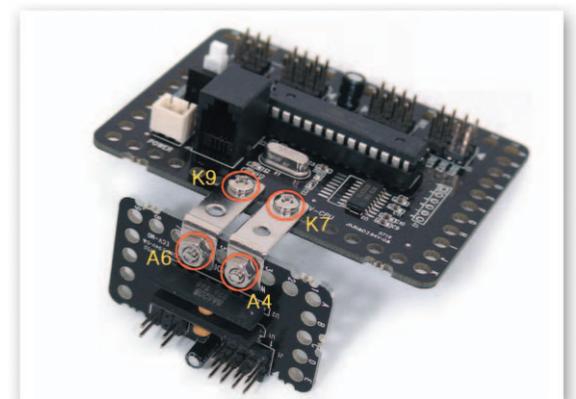
2 Put the Motor Frame that is fixed on the DC Motor on the Main Frame and fix it only with bolts.



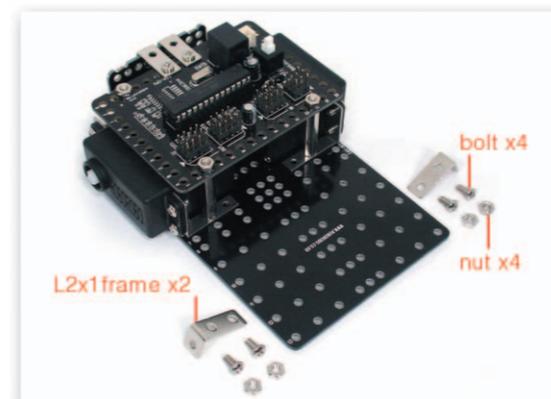
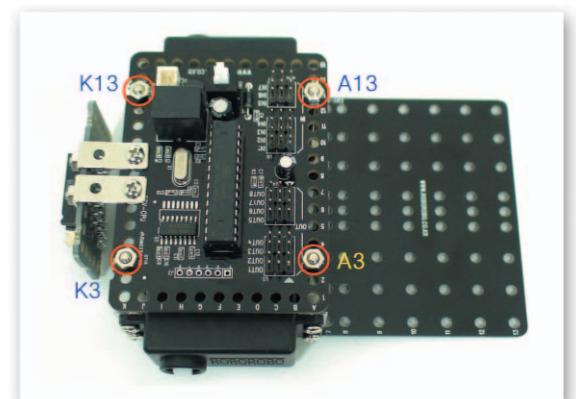
3 Twist-insert the 25mm Support on the bolt to which the Motor Frame is fixed.



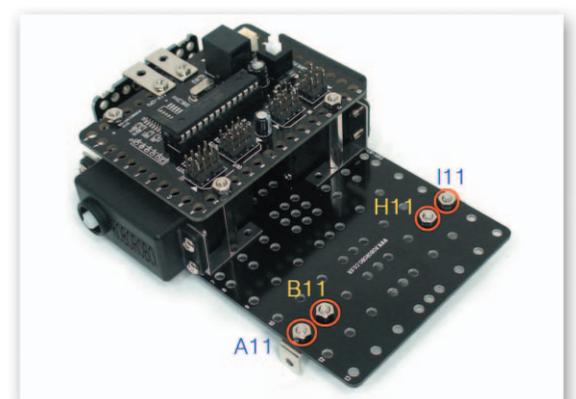
4 Use the L-type 2x1 Frame to connect the CPU Board and the DC Motor Drive Board with bolts and nuts.



5 Put the CPU Board on the Support that is fixed on the Main Frame and fix with nuts.

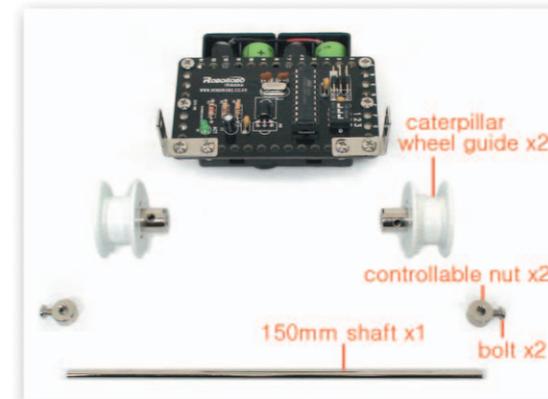
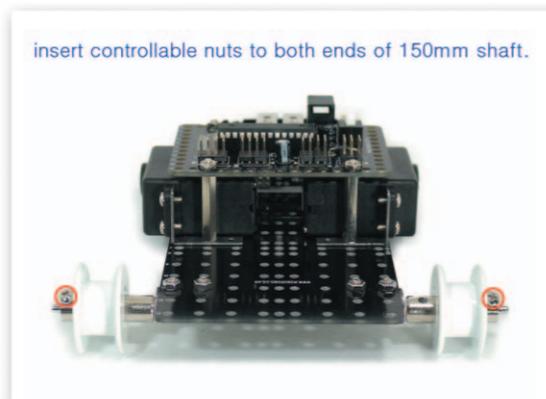
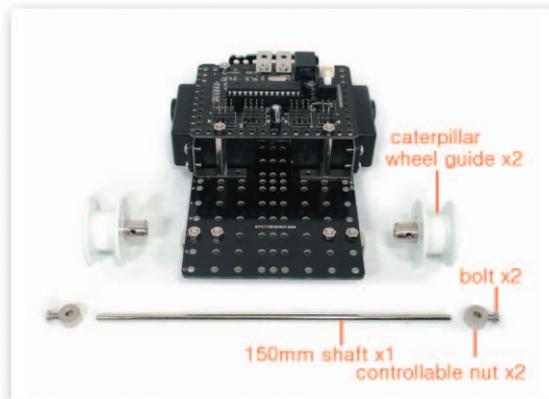


6 Put the L-type 2x1 Frame under the Main Frame and then fix with bolts and nuts.



# How to Assemble

# CaterpillarBot



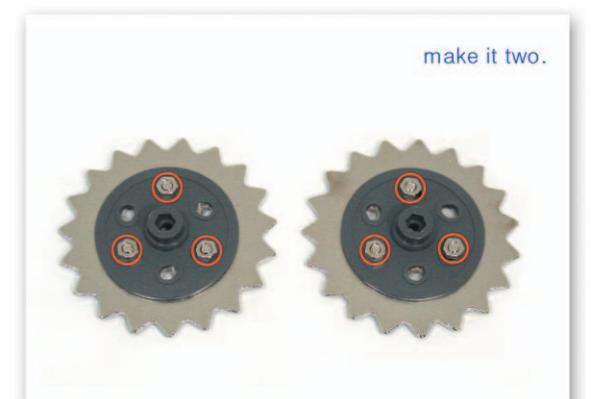
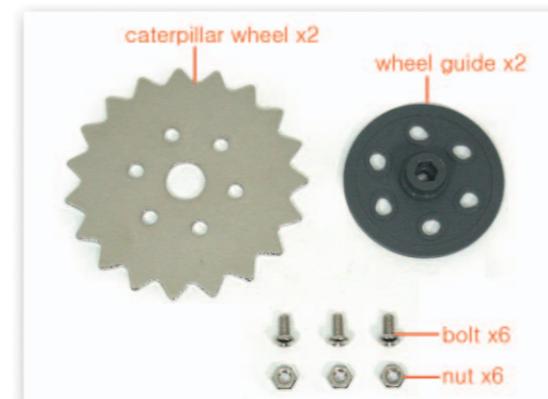
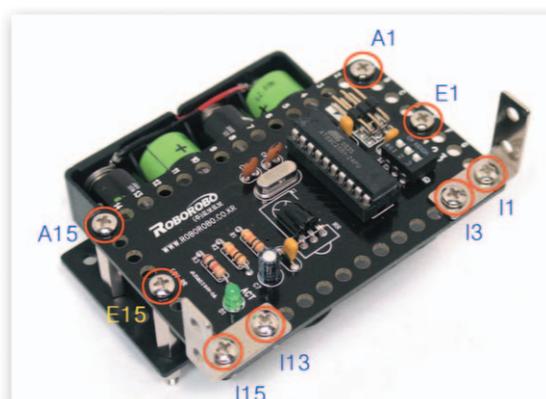
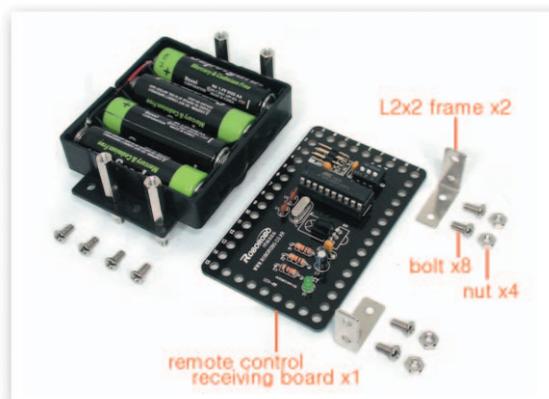
7 Insert the 150mm Axle to the L-type Frame that is fixed to the Main Frame and then insert the Caterpillar Wheel Guide to both sides. Also insert the Regulable nut to both sides and fix with bolts.

10 Insert the 150mm Axle to the L-type Frame that is fixed to Remote Control Receiving Board then insert the Caterpillar Wheel Guide to both ends. And fix with bolts by inserting the Regulable nut to both ends.



8 Fix the 7mm Support and the 20mm Support on the Battery Case.

11 Put the 7mm Support that is fixed to the Battery Case on the Main Frame and fix with nuts.

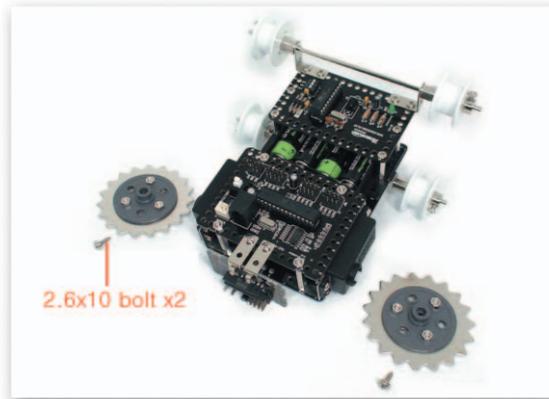


9 Connect the L-type 2x2 Frame to Remote Control Receiving Board, and then put Remote Control Receiving Board to the 20mm Support that is fixed to the Battery Case and fix with bolts.

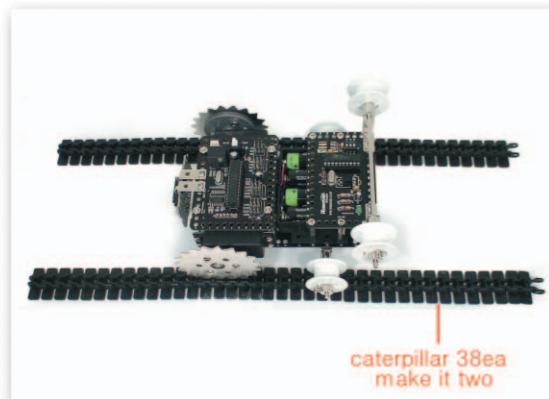
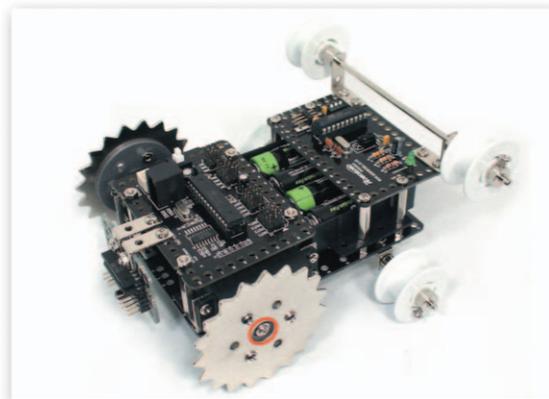
12 Put the Wheel Guide on Caterpillar Wheel and then fix with bolts and nuts.

# How to Assemble

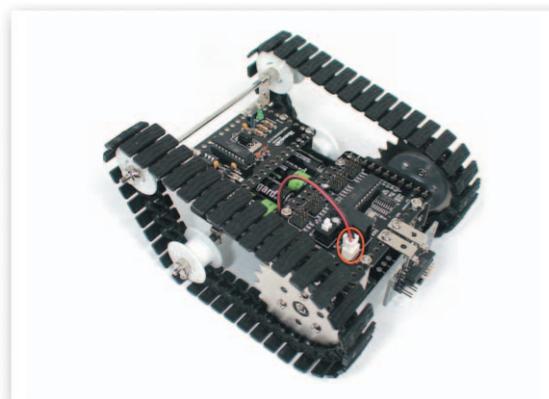
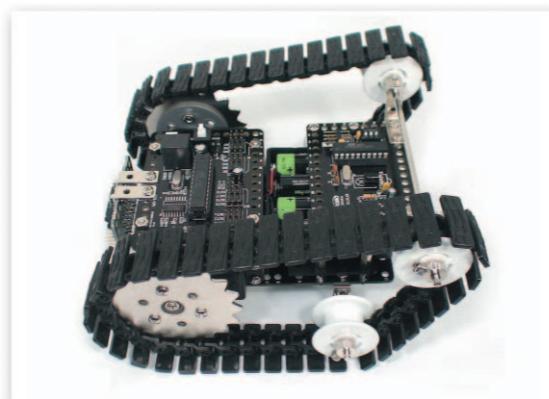
# CaterpillarBot



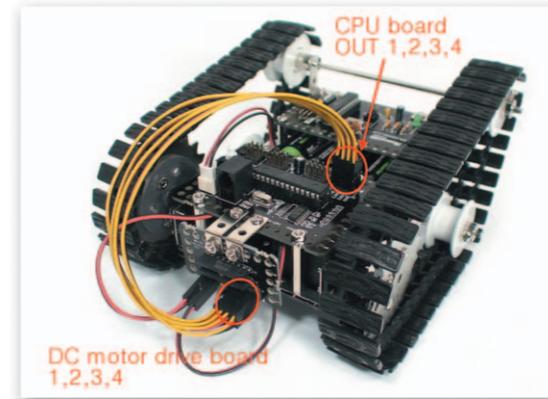
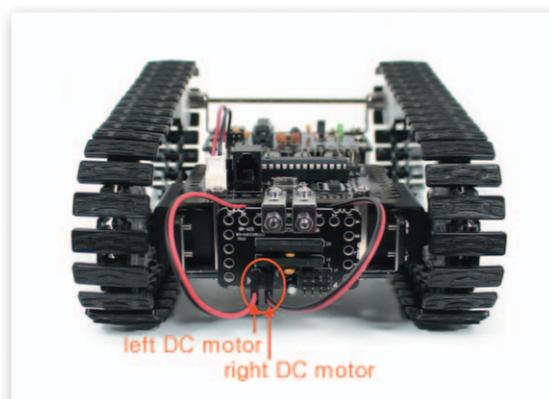
13 Insert the Wheel Guide that is connected to the Caterpillar Wheel to the DC Motor Axle and then fix with the 2.6x10 bolts.



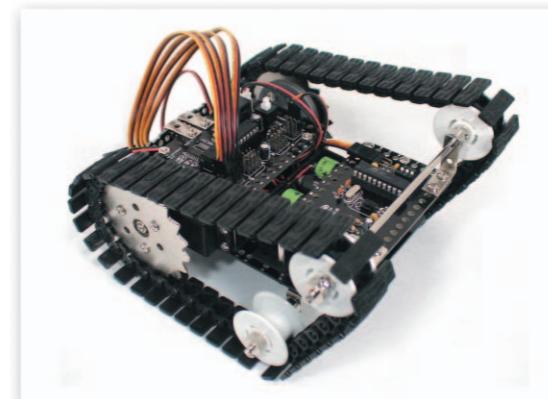
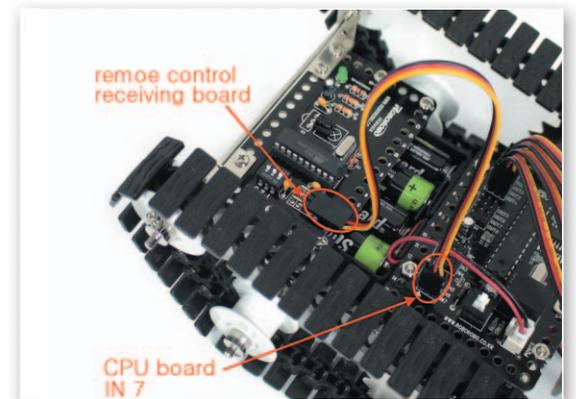
14 Fix the 38 connected Caterpillars by two lanes to the Caterpillar Wheel and the Caterpillar Wheel Guide.



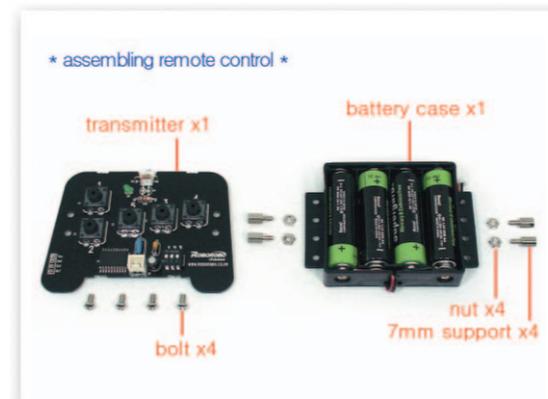
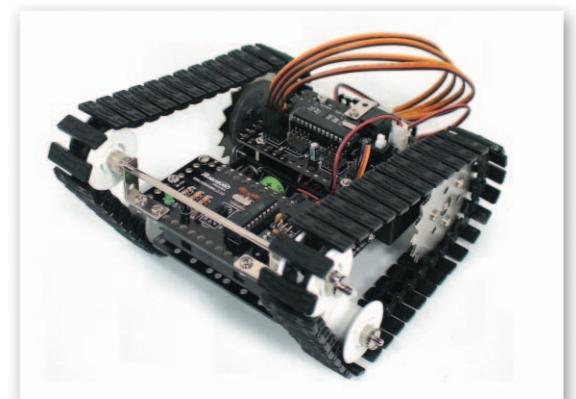
15 Connect the Power Cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor Cable to A, B of the DC Motor Drive Board.



16 Connect the 3 Pin Cable to the CPU Board's OUT Port 1, 2, 3, 4 and 1, 2, 3, 4 of the DC Motor Drive Board. To use a Remote Control, connect the 3 Pin Cable to IN Port 7 and the Remote Control Receiving part.



17 Completed CaterpillarBot.



18 Fix the 7mm Support to the Battery Case and then put the Remote Control Sending Board on it and fix with bolts. Completed Wireless Remote Control.



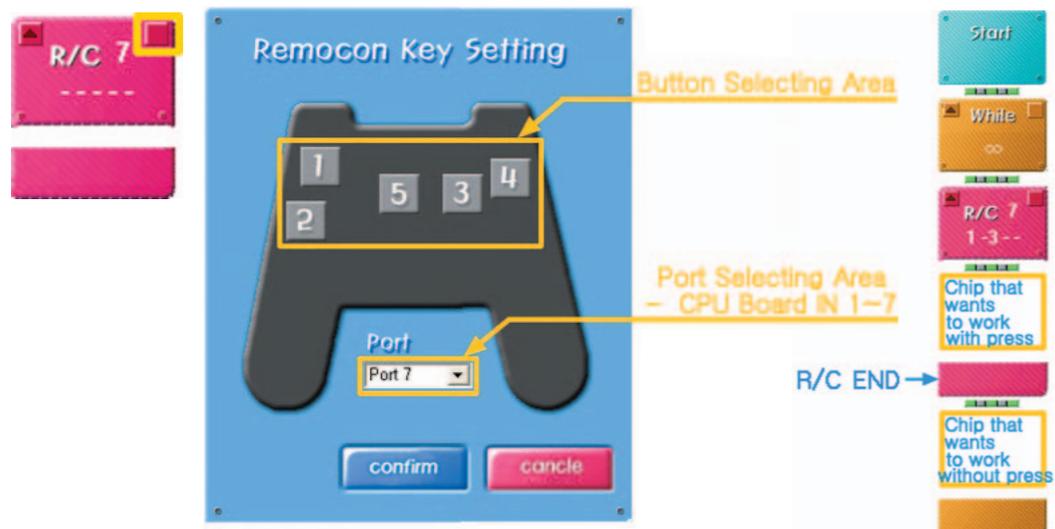
# Explain the Program

# CaterpillarBot

## Remote Control Chip

- Main Function : It controls selected motion with wireless Remote Control.
- Application : Insert the chip into the R/C chip if the chip corresponds to the motion only when you press the button. On the contrary, if it corresponds to the motion when you do NOT press the button, insert the chip between the R/C END chip and the WHILE chip.

[Example]



### Try this!

Try to set as the Remote Control Receiving Board uses the Button 1 of the remote control connected to the IN port of the CPU board. How does the chip change?



### Try this!

Set as moving forward when pressing button 1 of the Wireless Remote Control.



▶ Why is the robot continuously moving forward?

-----

-----

-----

### Try this!

Set up as it moves with pressing button 1 of the Wireless Remote Control and stops without pressing.



▶ Why does it stop without pressing a button?

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# Shall we make it move?

# CaterpillarBot

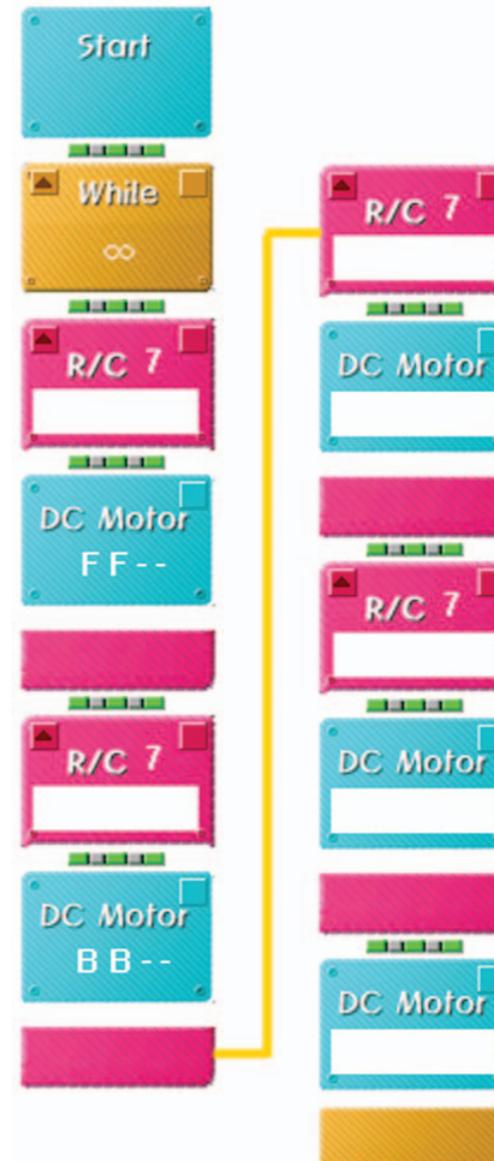
1 Make it move forward when pressing button 1 of the Wireless Remote Control.



2 Make it move forward when pressing button 1, move backward when pressing button 2.



3 Make it move forward when pressing button 1, move backward with button 2, turn left with button 3 and turn right with button 4.



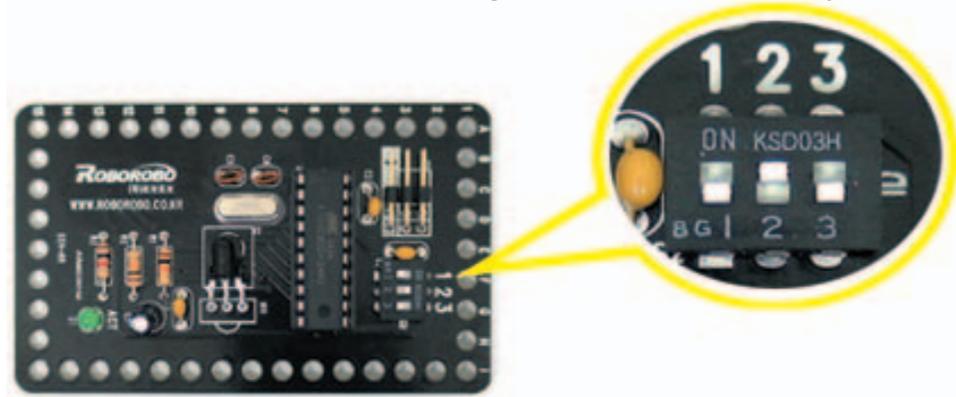
4 Make a track of rough and difficult ground by piling thick books in shape of stairs and operate with the Wireless Remote Control to let the Caterpillarbot pass.

# What did you learn?

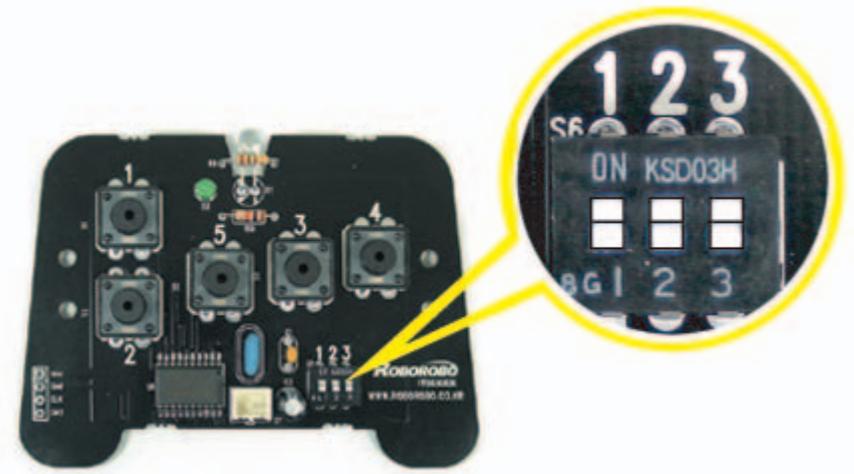
# Work of the Day

1. When ID of the Wireless Remote Control Receiving Board is set as below, how D of the Wireless Remote Control Receiving Board should be set ? (Try to color it.)

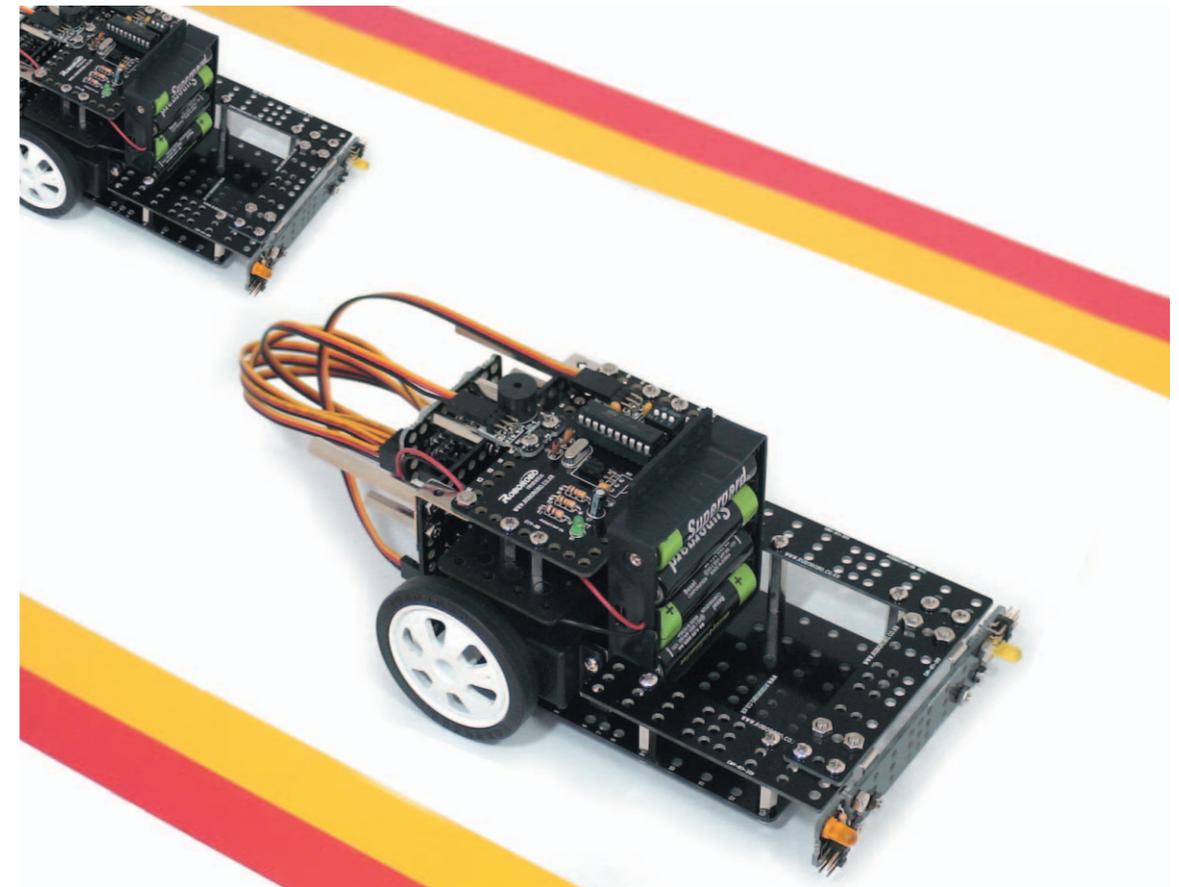
[The Wireless Remote Control Receiving Board and the ID Set-up Switch]



[The Wireless Remote Control Sending Board and the ID Set-up Switch]



Teacher's Evaluation and Task	Teacher's Confirmation



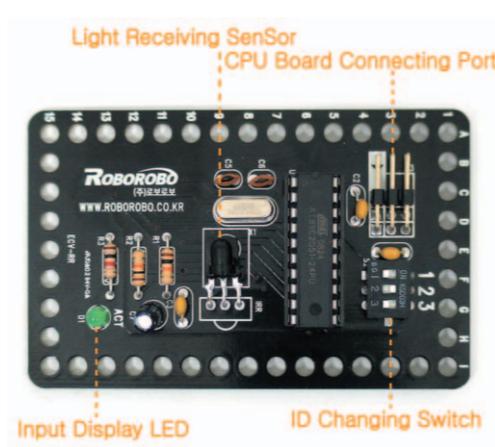
**KartBot** is a racing car robot that is controlled by the Wireless Remote Control. Learn about the Wireless Remote Control that exchanges signals using infrared rays and about using methods of the Wireless Remote Control's duplication buttons. Try to control Kartbot more diversely by using duplication buttons!

- ▶ Kart : a very small motor vehicle (160~170cm) made with minimum parts to use for racing.
- ▶ Racing car : a vehicle that is made for various racing games

## • • • Wireless Remote Control • • •



Wireless Remote Control Sending Board



Wireless Remote Control Receiving Board

A Remote Control means controlling a machine in the far distance wirelessly. The Remote Control is a very convenient machine that can switch on or off the electronics without touching and changing channels by using electromagnetic waves.

The electromagnetic wave includes light · an electric wave · infrared rays · ultraviolet rays · X-rays, and among them, we are only able to see light(visible ray) with our eyes. When we order by pressing the Remote Control button, infrared rays or a supersonic wave · an electric wave etc are emitted from a sensor of the Remote Control. The general Remote Control that is usually used to watch TV in home uses infrared rays that has lower frequency than visible rays.

A thing that makes infrared rays within a machine is a semi-conductor that is called as a light emitting diode, on the contrary, it is called a light receiving diode that receives infrared.

A light emitting sensor is in the Remote Control and a light receiving sensor is in TV, audio or in other electronics.

Therefore, when you press TV channel 7 with the Remote Control, a light emitting diode shoots the infrared ray that has innate frequency and a light receiving diode of TV receives the signal to change a screen to channel 7.

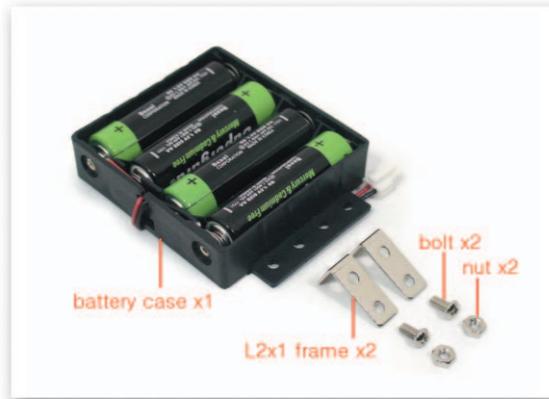
Also infrared blinks at high speed when pressing the volume button of the Remote Control. At this time, the signal that the volume button has been pressed is sent at first and then increase or decrease the volume by which the pertinent light receiving diode of TV recognizes the number of infrared rays' blinks.

The Remote Control, can function if it is not pointing to electronics directly. This is because infrared ray is reflected by from the wall · mirror and so on. However, the black color has the property of absorbing infrared rays so it will not work very well on the black wall papers, Infrared rays are not visible but, they are all over the earth. Half of the solar energy is infrared ray.

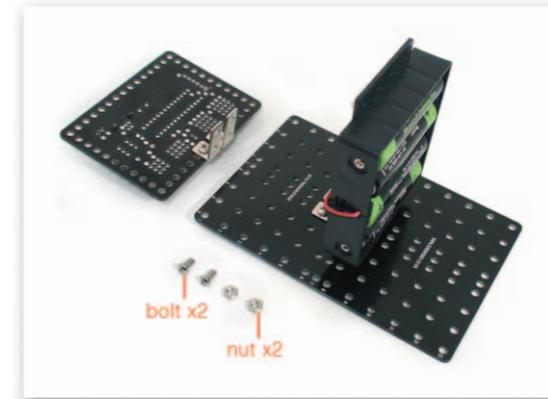


# How to Assemble

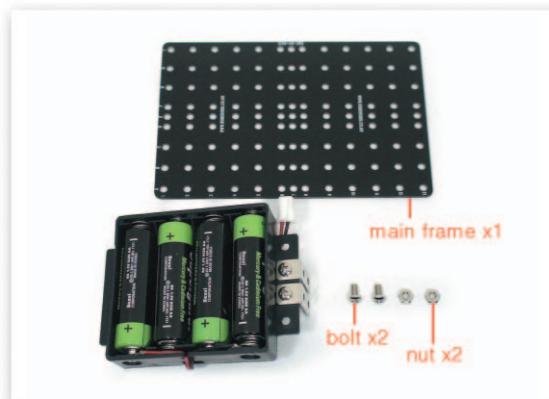
# KartBot



1 Fix the L-type 2x1 Frame on the Battery Case with bolts and nuts.



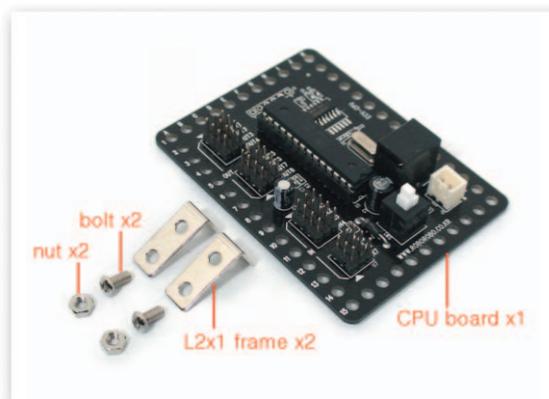
4 Fix the L-type 2x1 Frame that is fixed to CPU Board to the Main Frame using bolts and nuts.



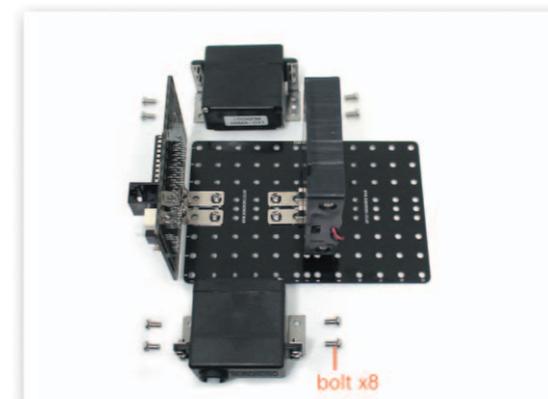
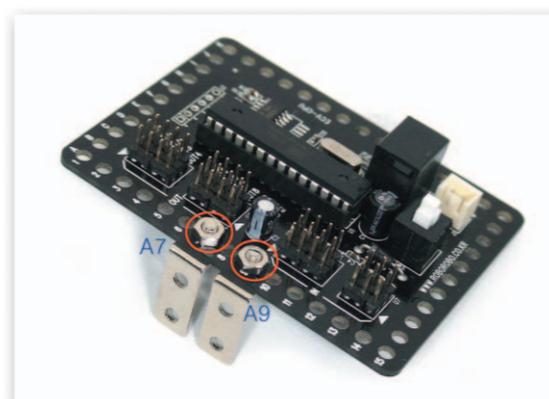
2 Fix the L-type 2x1 Frame that is fixed to the Battery Case to the Main Frame.



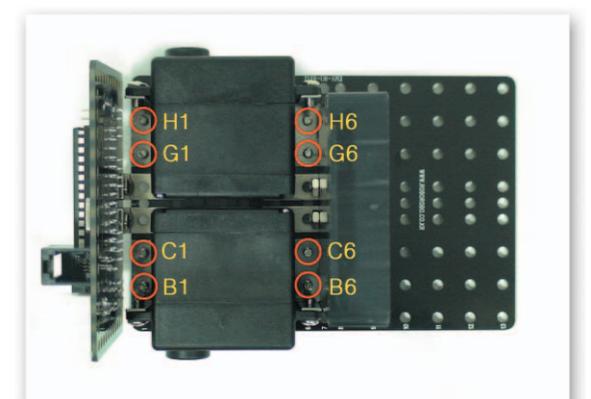
5 Fix the DC Motor and the Motor Frame using only bolts.



3 Fix the L-type 2x1 Frame to the CPU Board with bolts and nuts.

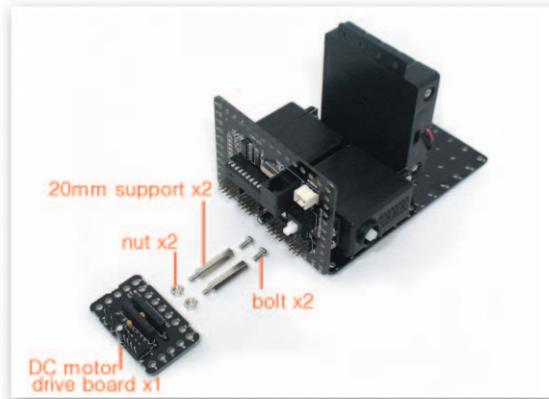


6 Put the Motor Frame that is fixed to the DC Motor on the Main Frame and fix with only bolts.

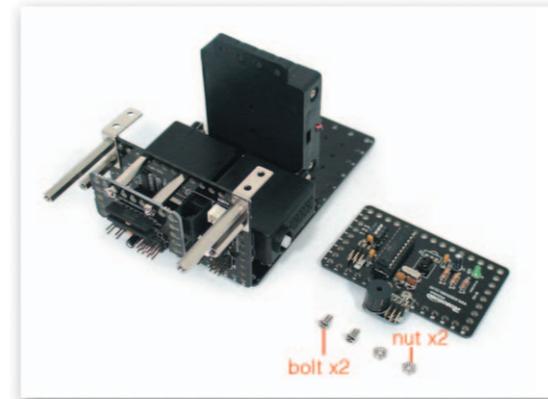


# How to Assemble

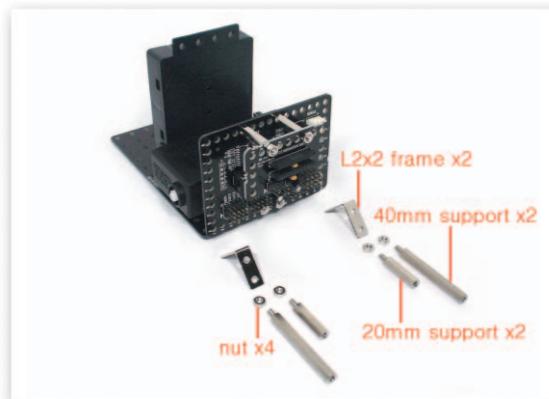
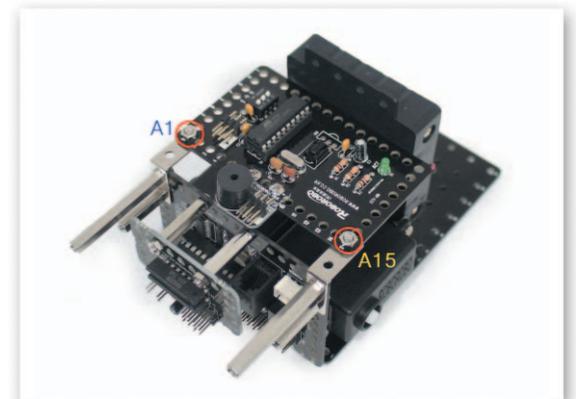
# KartBot



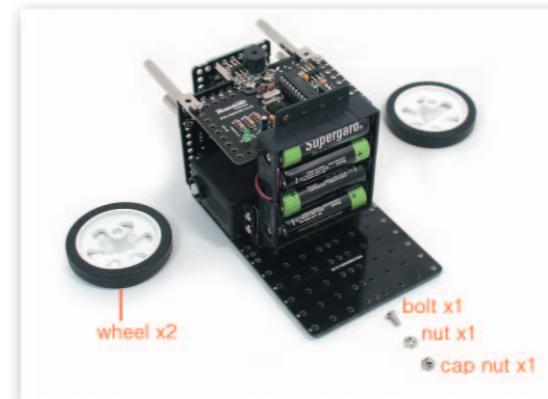
7 Fix the 20mm Support to the CPU Board with nuts and then put the DC Motor Drive Board on the 20mm Support and fix with bolts.



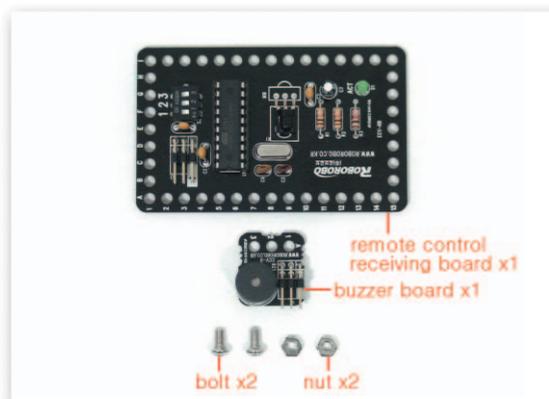
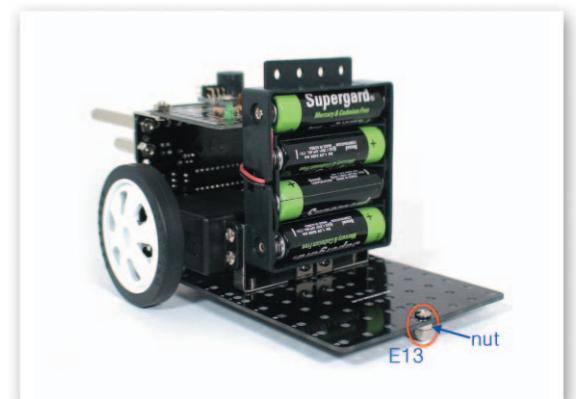
10 Put the Remote Control Receiving Board on the L-type Frame that is fixed to the CPU Board and then fix with bolts and nuts



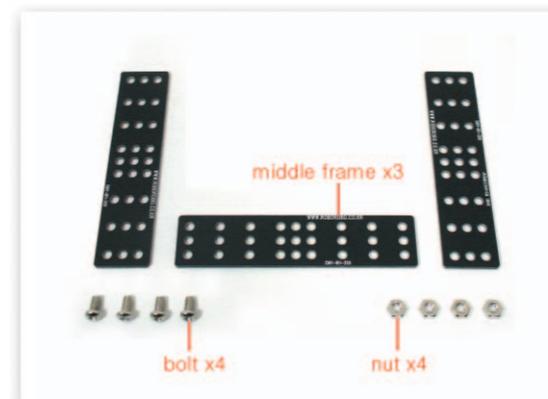
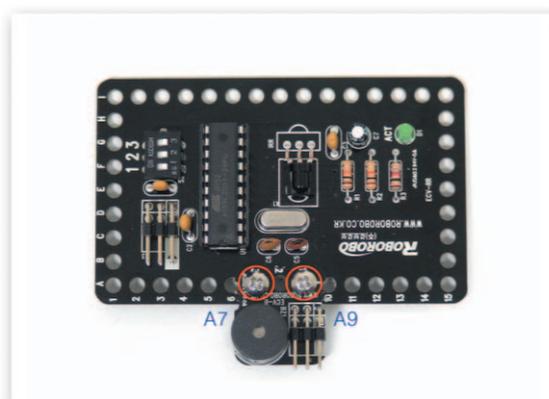
8 Fix the 20mm Support and the 40mm Support on the CPU Board like the L-type 2x2 Frame with nuts.



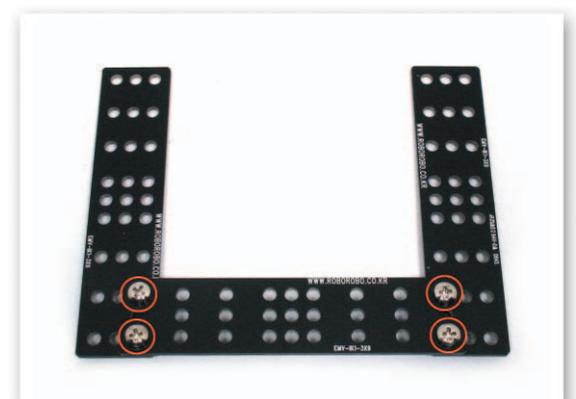
11 Insert a bolt into the Main Frame and fix with a nut and a cap nut, and then insert the wheel to the DC Motor's axle.



9 Put the Buzzer Board on the Remote Control Receiving Board and then fix with bolts and nuts.

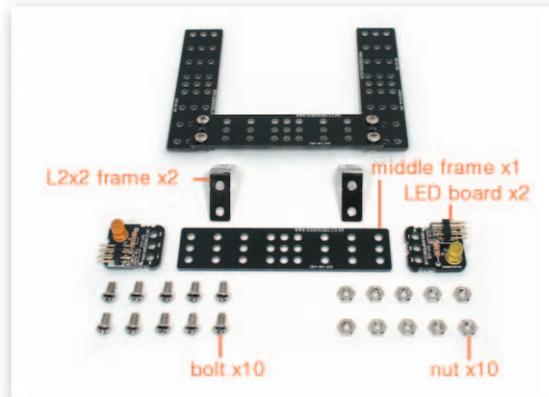


12 Overlap the Middle Frame as the shape of U, and then fix with bolts and nuts.

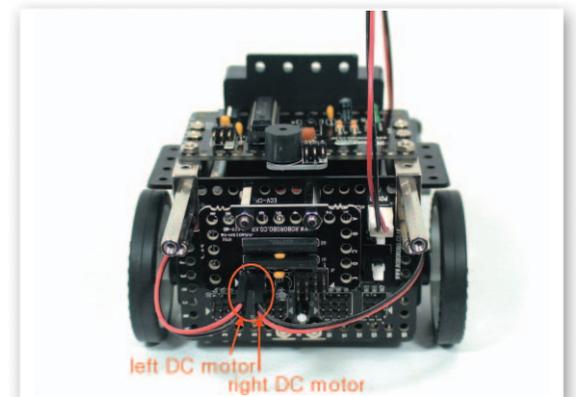
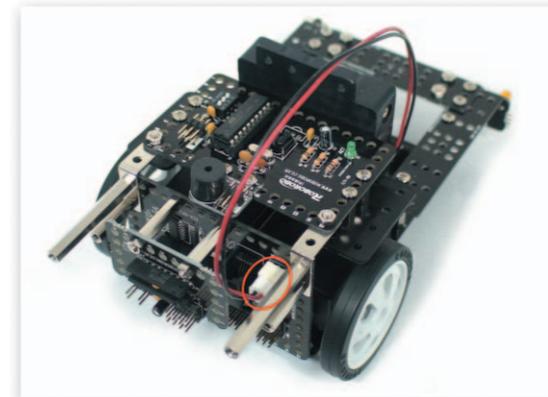


# How to Assemble

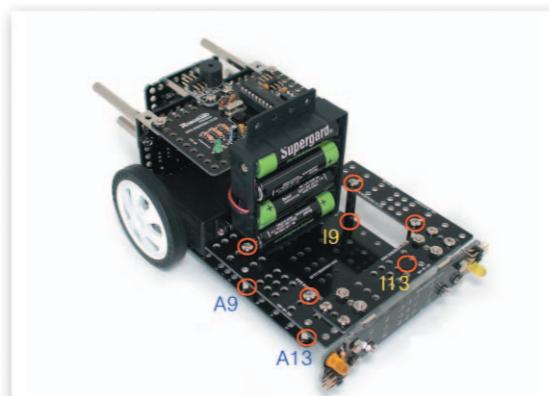
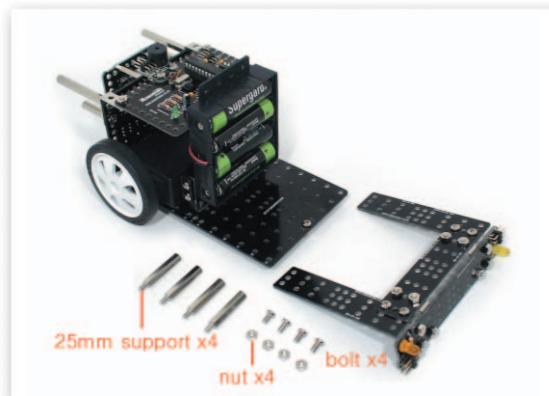
# KartBot



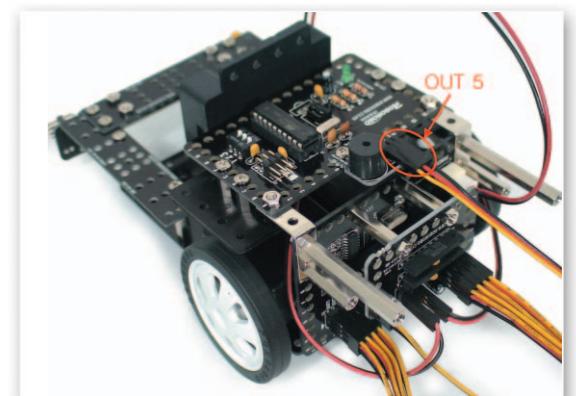
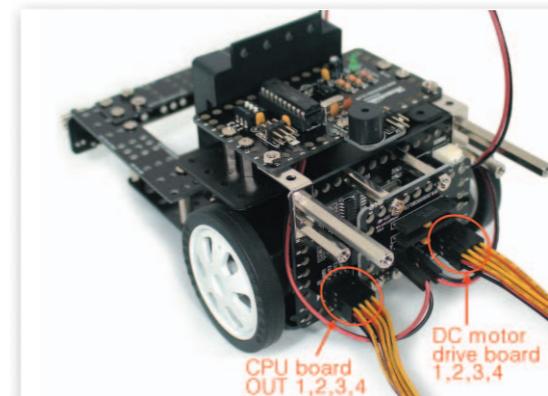
13 Fix the L-type 2x2 Frame to the U-shaped Middle Frame with bolts and nuts and then attach the prepared LED Board to the Middle Frame and fix to the L-type 2x2 Frame.



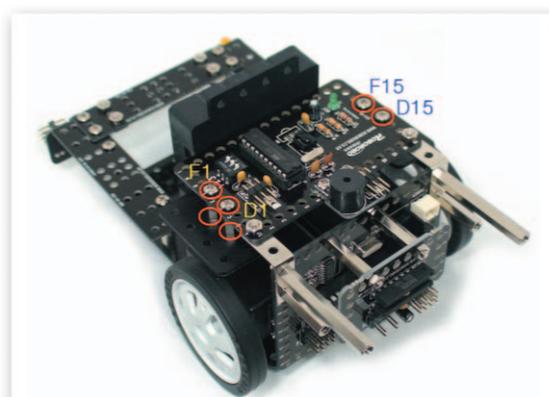
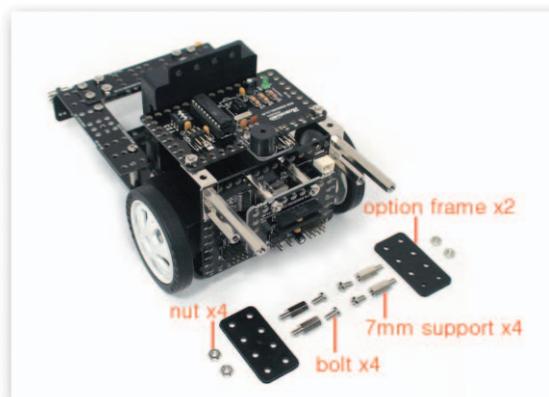
16 Connect the power cable of the Battery Case to the Power Connector. Connect the DC Motor cable to the DC Motor Drive Board A, B.



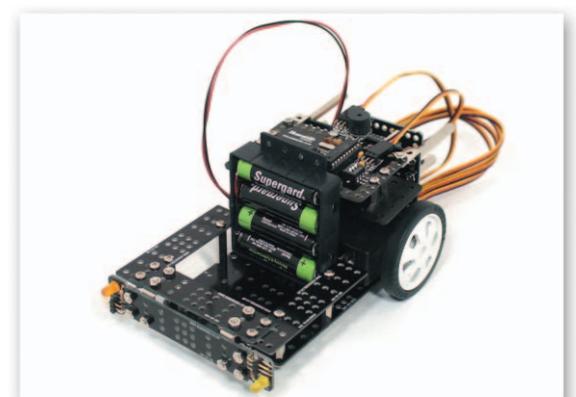
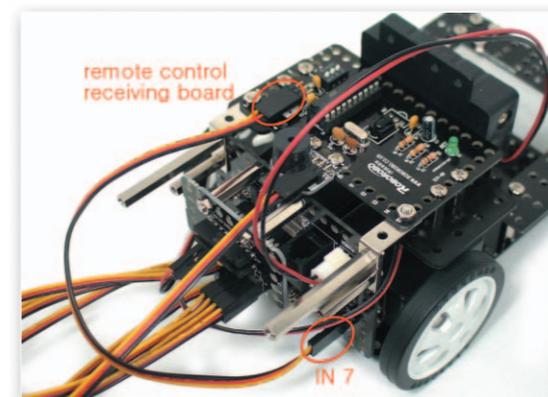
14 Fix the 25mm Support to the Main Frame, and then put the U-shaped Middle Frame and fix with bolts.



17 Connect the Pin Cable 3 to OUT Port 1, 2, 3, 4 of the CPU Board and 1, 2, 3, 4 of the DC Motor Drive Board. Connect the Pin Cable 3 to OUT Port 5 of CPU Board and the Buzzer Board.



15 Attach the 7mm Support to the Option Frame with bolts and then put under the Remote Control Receiving Board and fix with nuts.



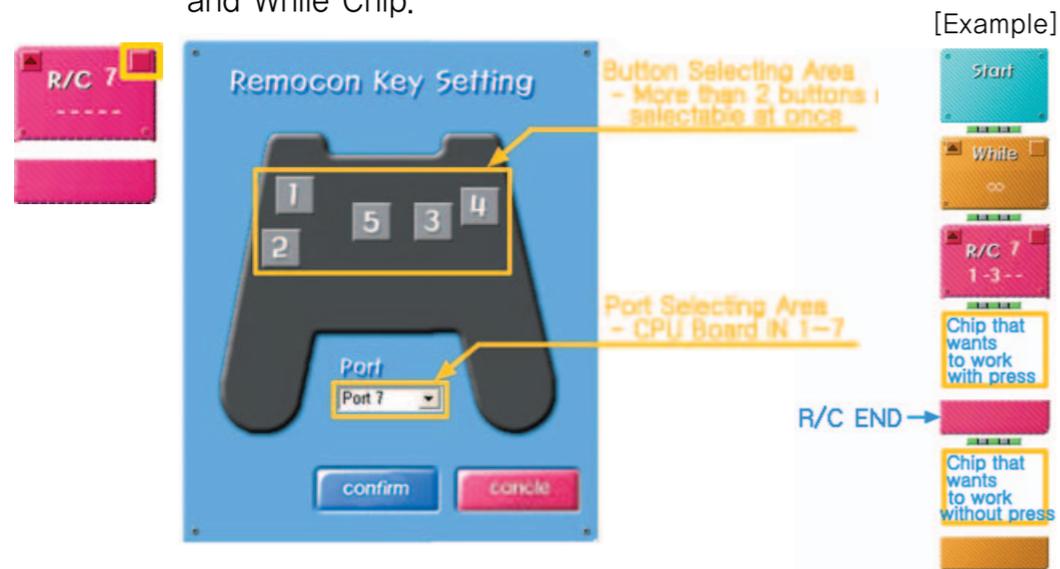
18 Connect the Pin Cable 3 to IN Port 7 of the CPU Board and the Remote Control Receiving Board. Completed KartBot.

# Explain the Program

# KartBot

## Using Method of R/C Chip Duplication Button

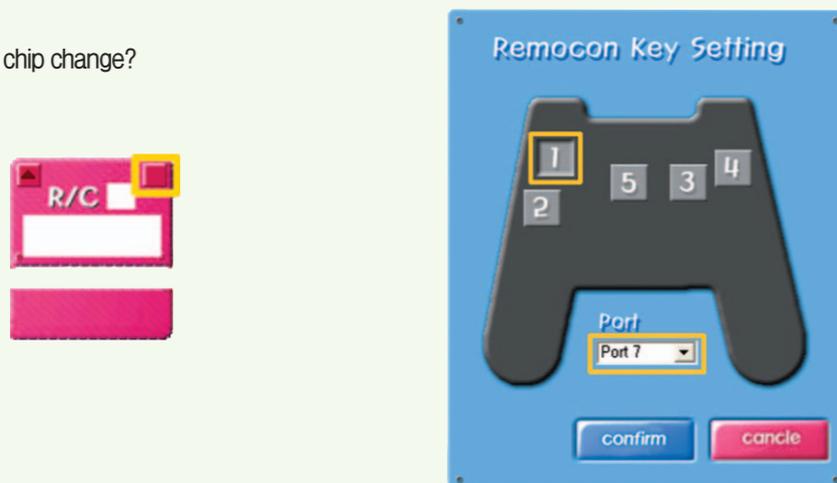
- Main Function : A chip that makes to control It operates the selected motion with the Wireless Remocon Remote Control.
- Application : If the chip corresponds to the motion you want to make when more than two buttons are pressed at once, insert chip between R/C Chips. If the chip corresponds to the motion you want to make when you do NOT press the button, insert the chip between R/C END Chip and While Chip.



### Try This!

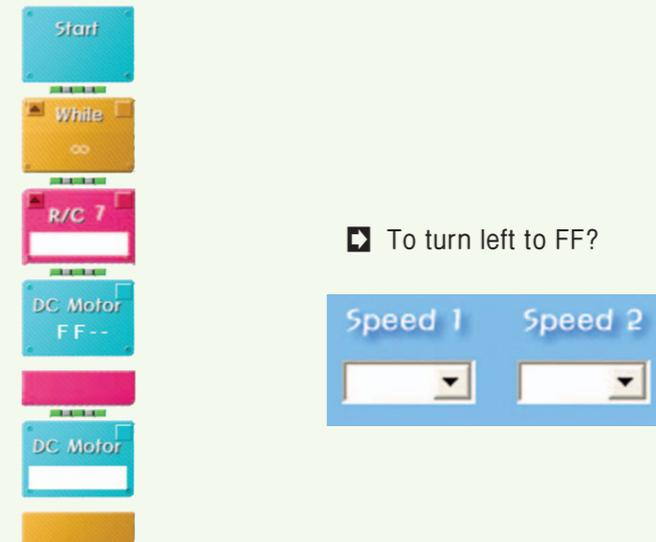
Set to use the button 1, 3 at once which is connected to IN Port 7 of the CPU Board. How does the chip change?

How does the chip change?



### Try This!

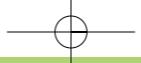
Set as it turns left while it moves forward when press the button 1, 3 of the Wireless Remote Control at once



### Try This!

Make it turn left while moving forward when press the button 1, 3 of the Wireless Remote Control and make buzzer ring twice when press button 5.





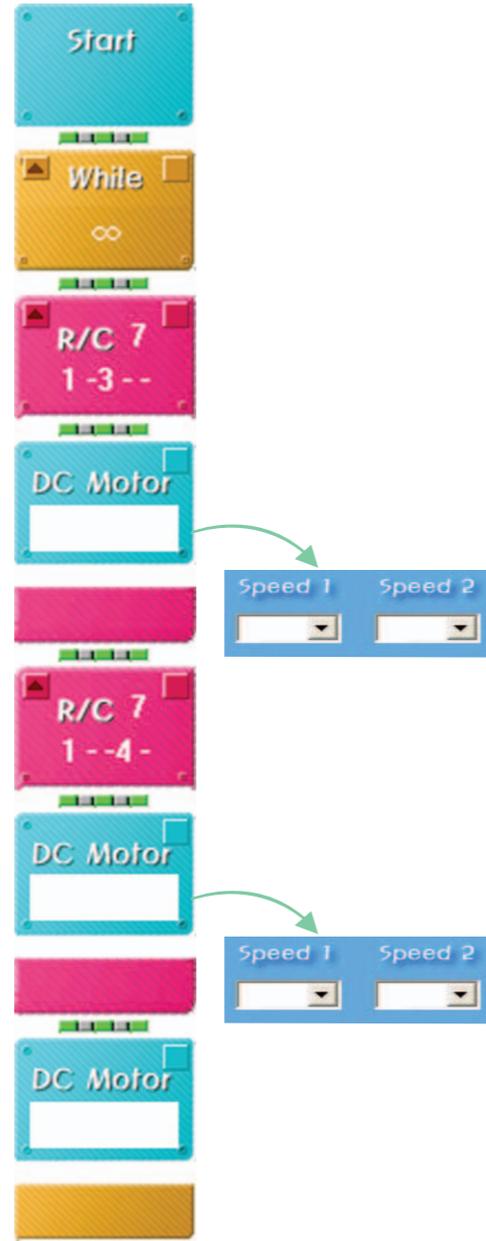
# Shall we make it move?

# KartBot

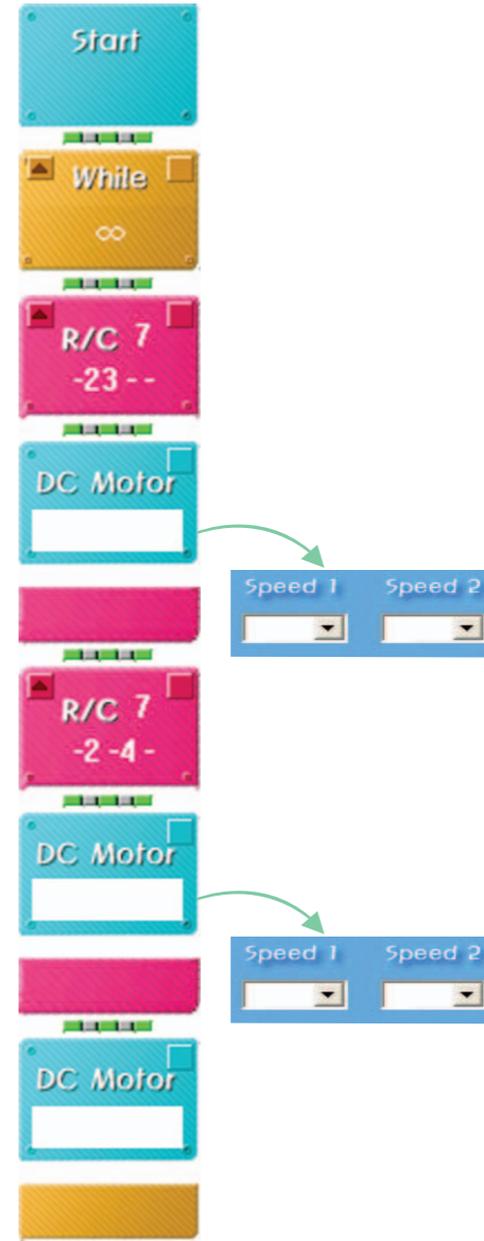
1 Make it move forward when pressing button 1, move backward when pressing button 2.



2 Make it turn left moving forward when pressing button 1, 3 and turn right moving forward when pressing button 1, 4.



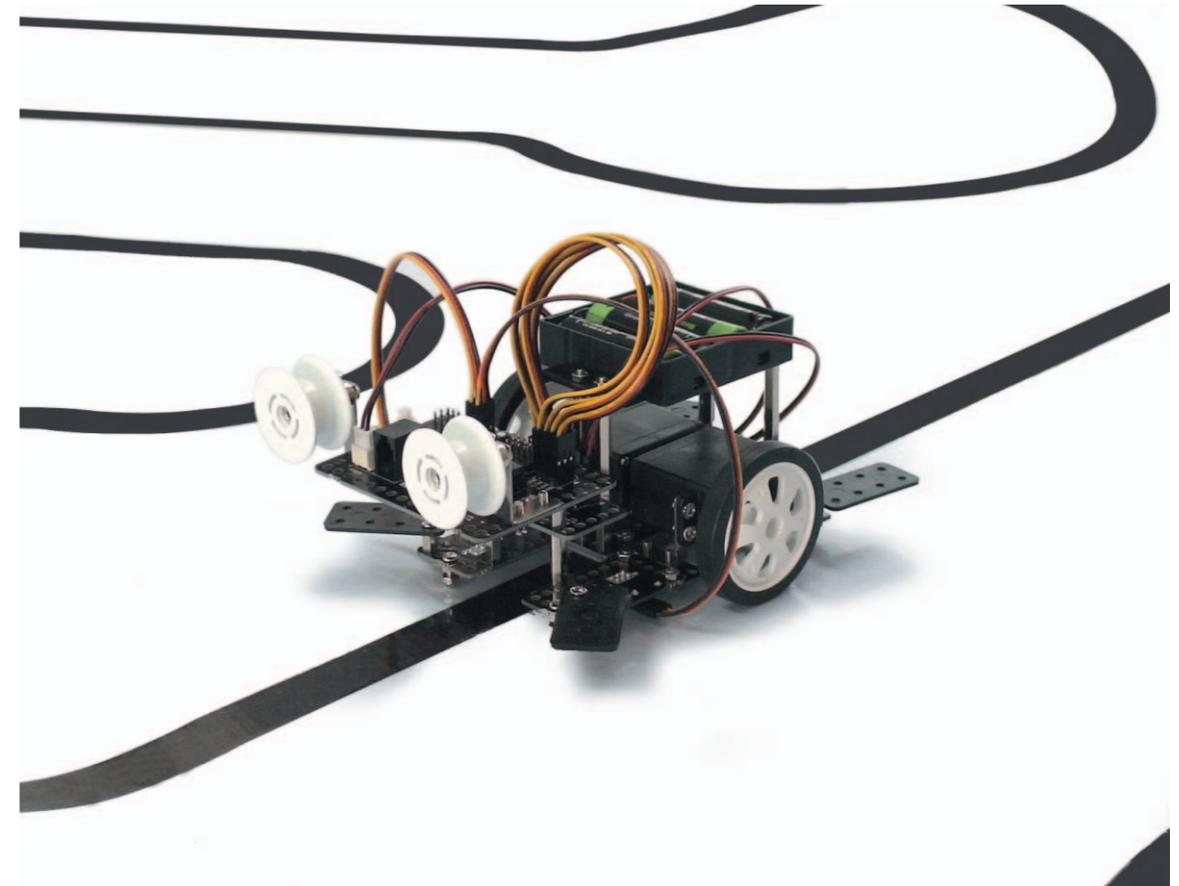
3 Make it turn left moving backward when pressing button 2, 3 and turn right moving backward when pressing button 2, 4.



# What did you learn?

# Work of the Day

1. Considering the condition of ground in the picture below, choose a right tire.

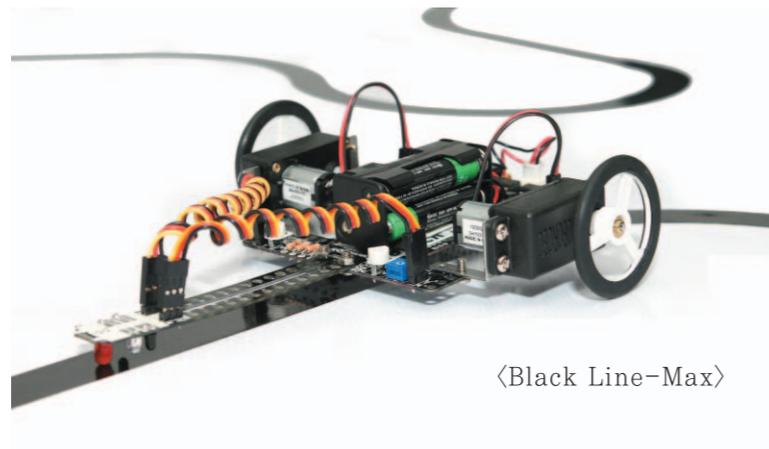


**TurtleBot** is a line-tracer robot that drives along the line. Learn about the line-tracer's principle that distinguishes black from the white colors with a infrared sensor and have a race with a Line tracer to see who drives the fastest!

- ▶ Turtle : A large reptile which has a thick shell covering its body and which lives in the sea
- ▶ Line : a long thin mark which is drawn or painted on a surface
- ▶ Tracer : chaser

Teacher's Evaluation and Task	Teacher's Confirmation

### • • • Line-tracer • • •



〈Black Line-Max〉

Line-tracer is a self-regulating movement robot that moves along the given driving track which is called as AGV (Automatic Guided Vehicle). The principle of Line-tracer is detecting the driving track drawn on a ground by a sensor and moving along the line to a destination.

Line-tracer is usually used in unmanned cars that automatically moves things at factories and it is applied and used in other industries as attaching a conveyer belt or a forklift to a line-tracer.

You can learn about CPU, Motor, Sensor and Programming through Linetracer and also it is very popular among students who start to study robots.

The structure of Line-tracer is usually composed of the cheap 8 bit CPU the DC Motor or Stepping Motor, the Infrared Sensor and so on. An Infrared Sensor is generally used more than 2 two groups (group 1 is Infrared Sensor – emitting part and receiving part) in order to follow the line smoothly.

The process of following line is as follow.

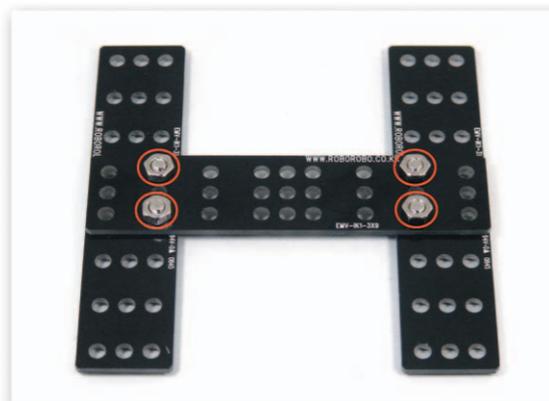
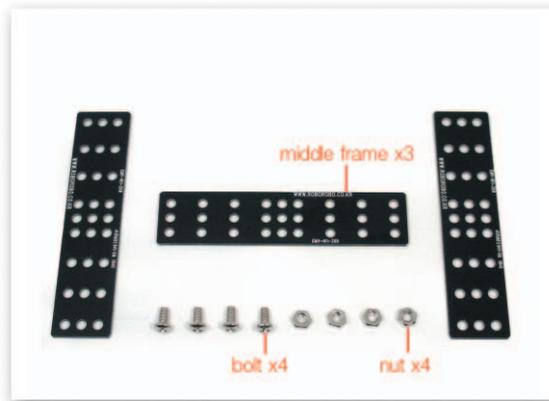
Detecting driving lane using the Infrared Sensor ⇒ Useful information for driving ⇒ Process in the CPU ⇒ Rotate Motor

General Line-tracer uses the Infrared Sensor to detect a driving lane. This Infrared Sensor can distinguish only black and white so a black line on the white background or a white line on the black background should be used. Black will absorb light and white will reflect because the light emitting part of the Infrared Sensor gives out the light of the infrared ray. It will detect the driving lane using this difference.

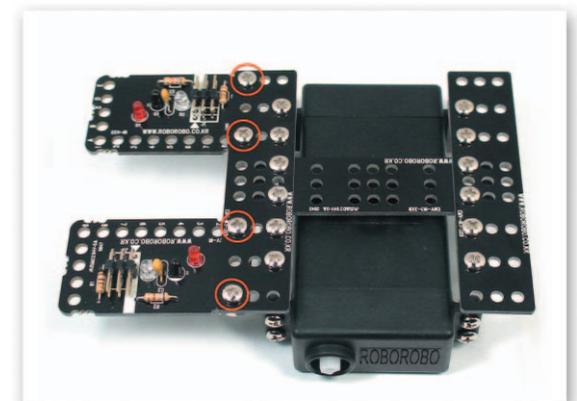
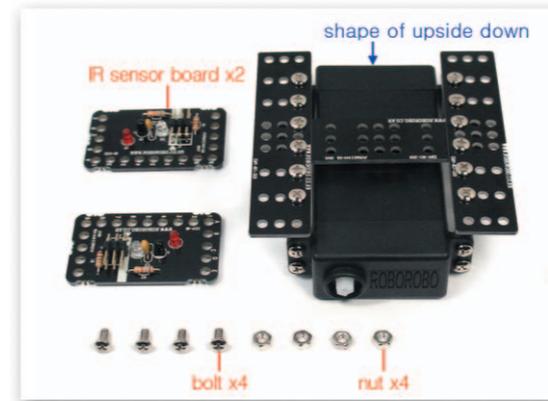
Why don't you make a Line-tracer to carry things by following lines in your house?

# How to Assemble

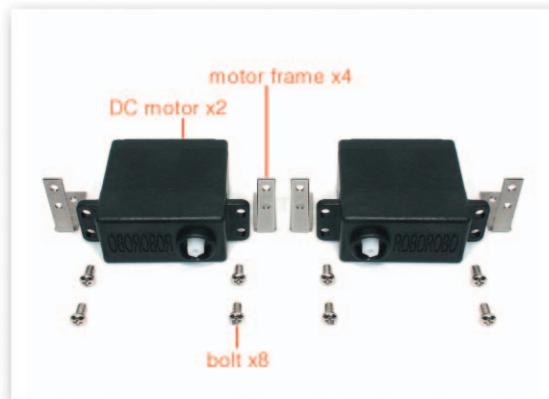
# TurtleBot



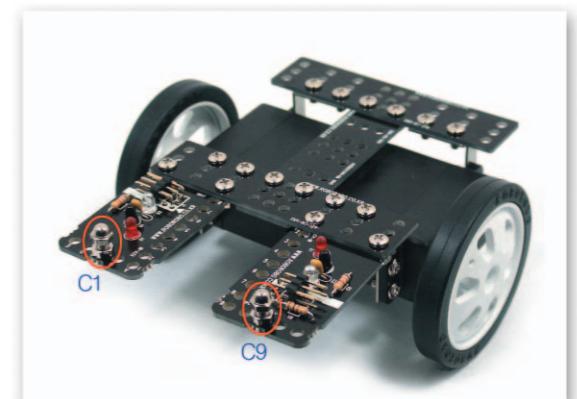
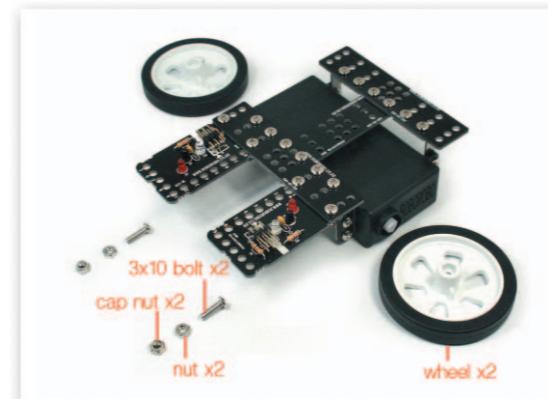
1 Overlap the Middle Frame and fix with bolts and nuts.



4 Put the Infrared Sensor Board on the Middle Frame and fix with bolts and nuts.



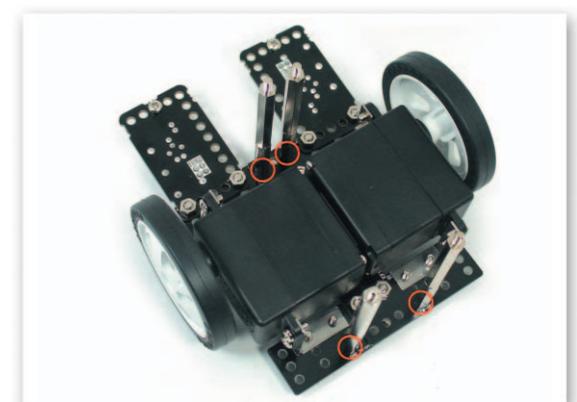
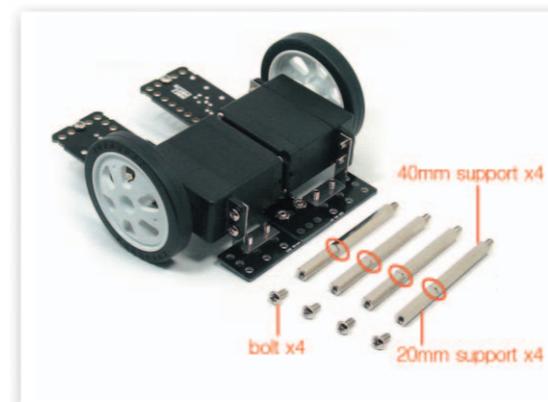
2 Fix the DC Motor and the Motor Frame using only bolts.



5 Insert bolts to the Infrared Sensor Board and fix with nuts and cap nuts, and then insert wheels to the DC Motor axle.



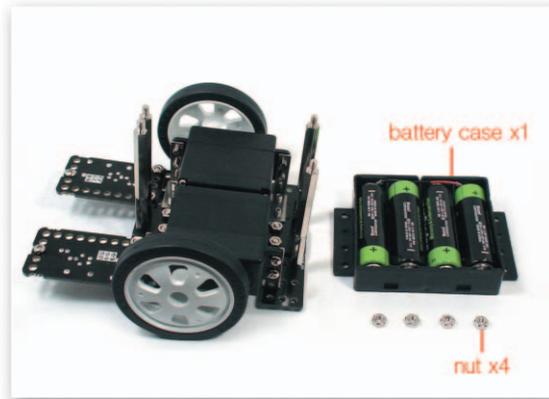
3 Put the Motor Frame that is fixed to the DC Motor on the Middle Frame and fix only with bolts.



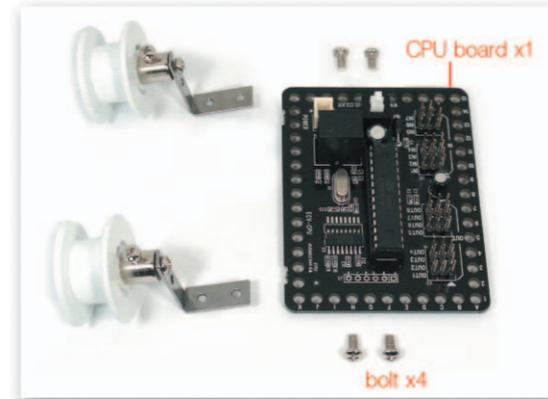
6 Connect the 20mm Support and the 35mm Support and then fix to the Middle Frame with bolts.

# How to Assemble

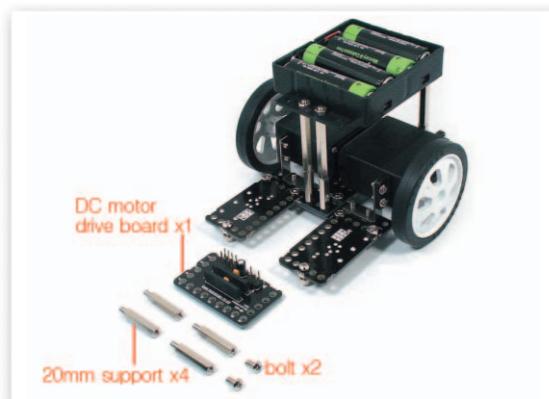
# TurtleBot



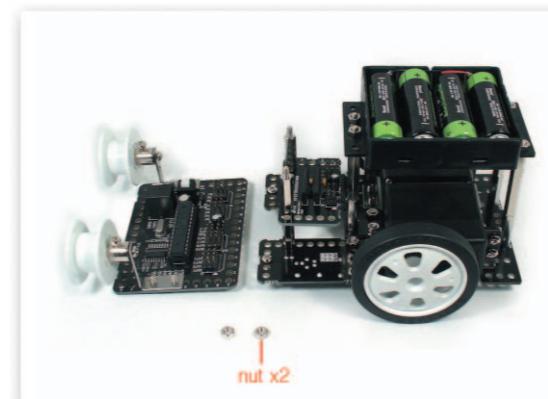
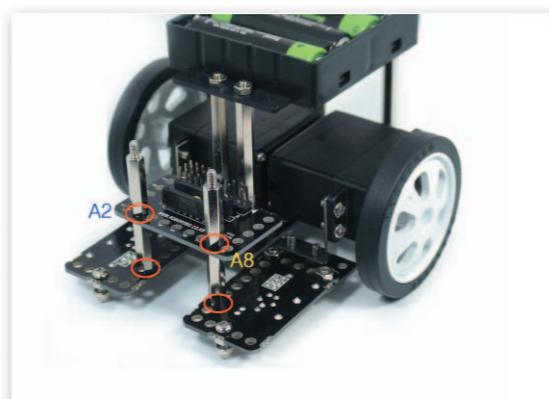
7 Put the Battery Case to the Support and fix with nuts.



10 Put the Motor Frame that is fixed to the Caterpillar Wheel Guide on the CPU Board and fix using only bolts.



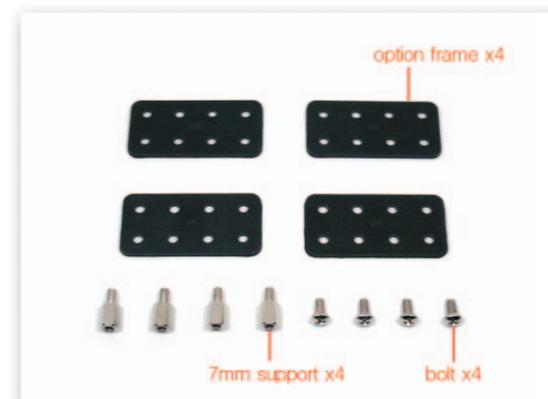
8 Fix the 20mm Support to the Infrared Sensor Board with bolts the then put the DC Motor Drive Board and fix with the 20mm Support.



11 Put the CPU Board on the Support and fix with nuts.



9 Fix the 3x10 Bolts to the Motor Frame then insert the Caterpillar Wheel Guide to the 3x10 Bolts and fix with bolts.

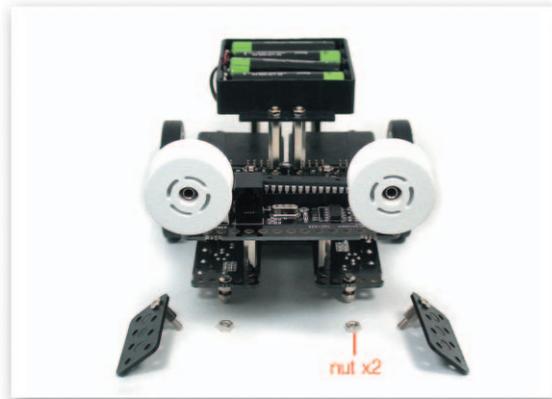


12 Put the 7mm Support on the Option Frame and fix with bolts.

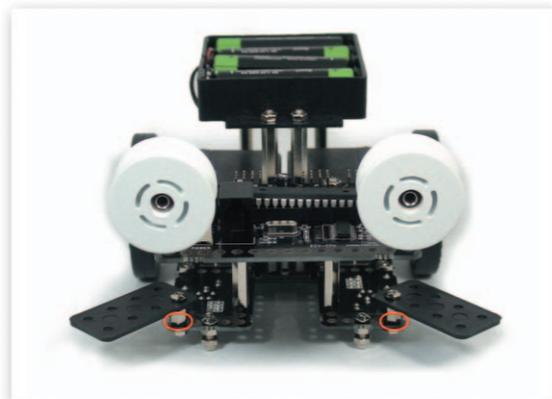


# How to Assemble

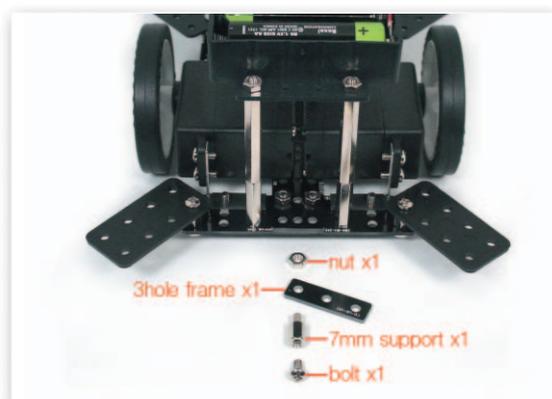
# TurtleBot



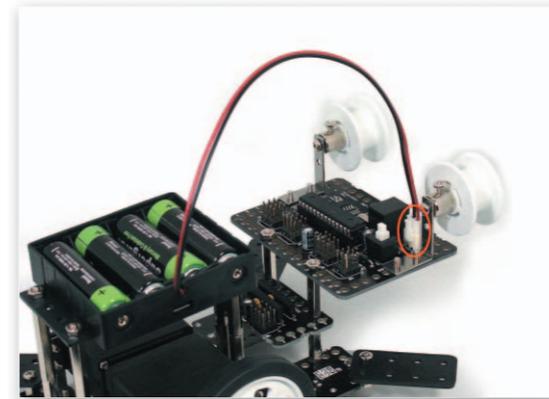
13 Put the Support that is fixed to the Option Frame on the Infrared Sensor Board and fix with nuts.



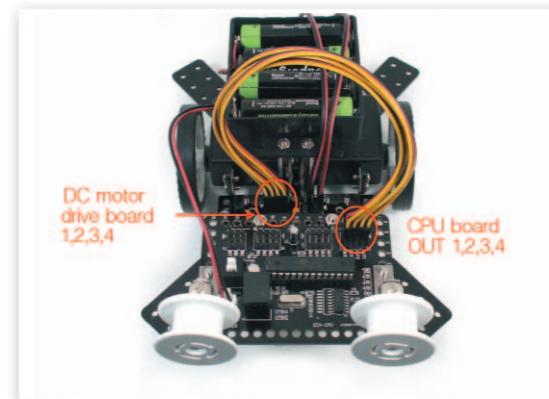
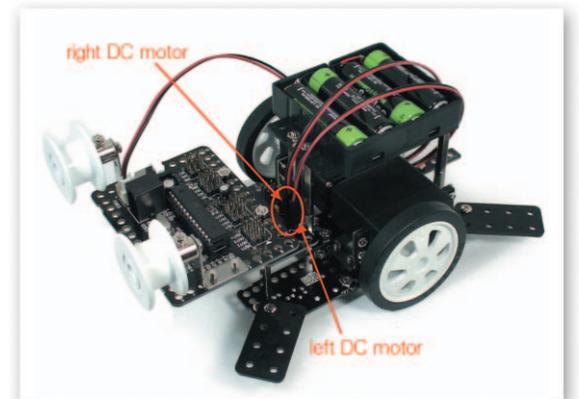
14 Put the Support that is fixed to the Option Frame on the Middle Frame and fix with nuts.



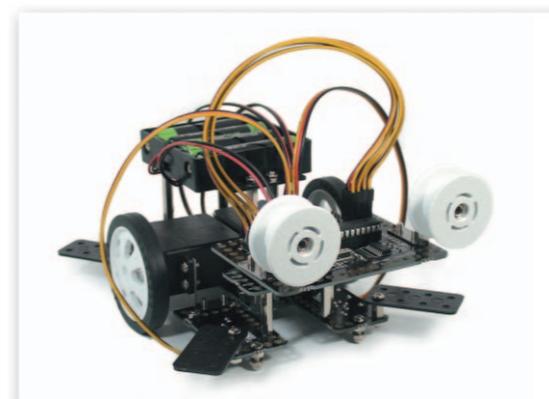
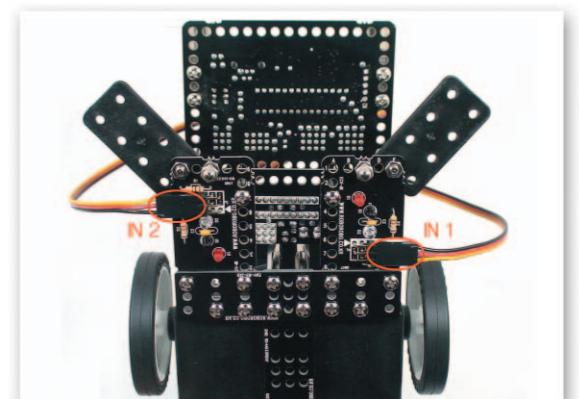
15 Fix the Small 3 Frame on the 7mm Support with nuts and then put them on the Middle Frame and fix with bolts.



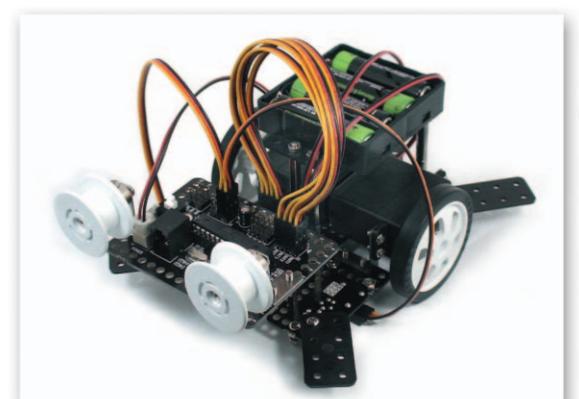
16 Connect the power cable of the Battery Case to the power cable of the CPU Board. Connect the DC Motor cable to A, B of the DC Motor Drive Board.



17 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and 1, 2, 3, 4 of the DC Motor Drive Board. Connect the 3 Pin Cable to IN Port 1, 2 of the CPU Board and the Infrared Sensor Board.



18 Completed TurtleBot



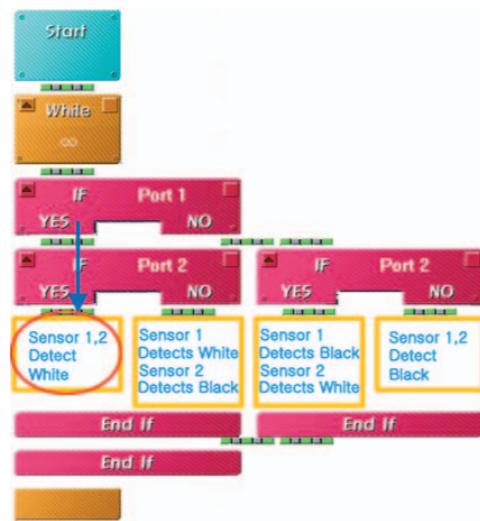
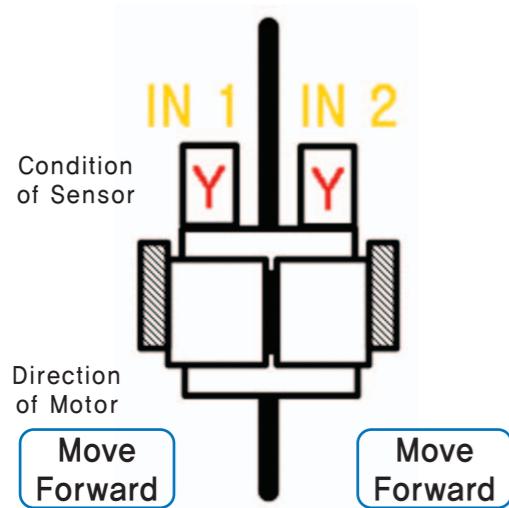
# Explain the Program

# TurtleBot

## Principle of Line-tracer

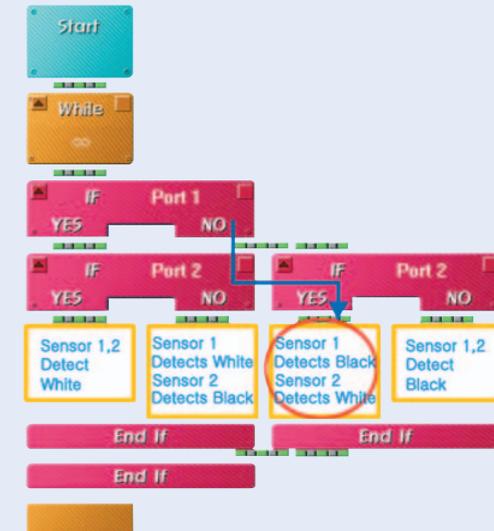
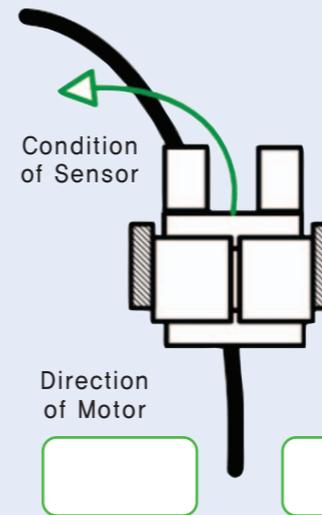
- Main Function : It distinguishes black from white and move along the driving lane.
- Application : sensor 1, 2 have detected white, insert chip to Port1's YES → Port2's YES.

[Example]



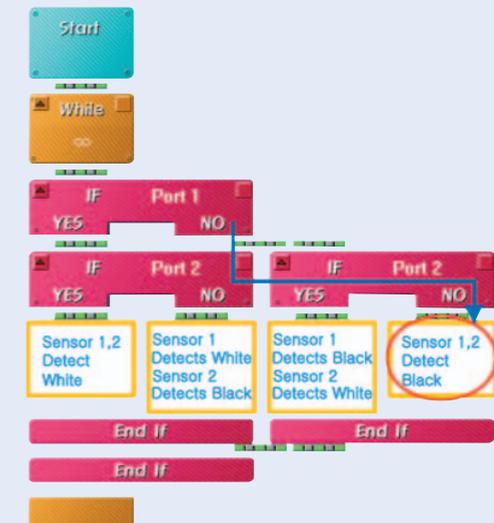
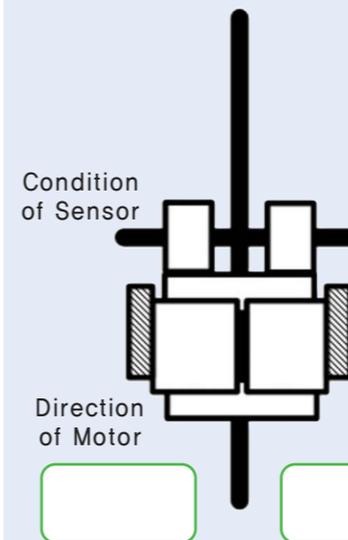
## Try This!

When the sensor 1 detects black and 2 detects white, insert the chip to Port1's NO → Port2's YES. How should the robot move?



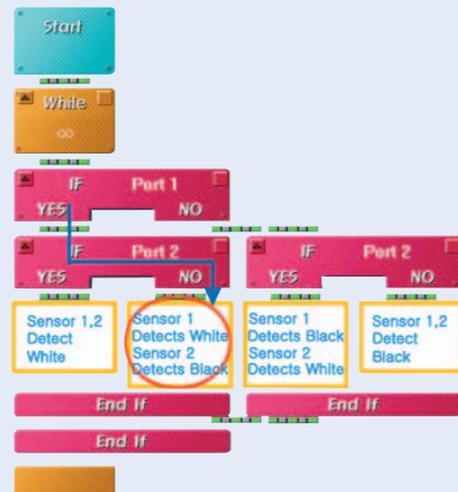
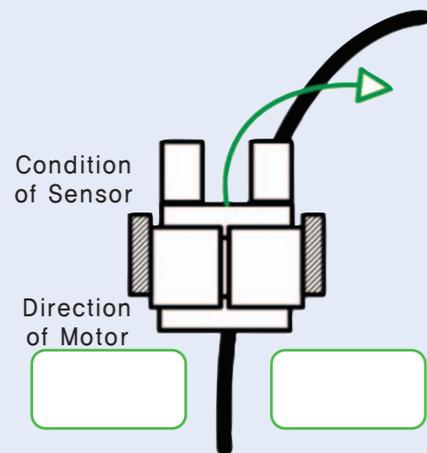
## Try This!

When the sensor 1, 2 have detected black, insert the chip to Port1's NO → Port2's NO. How should the robot move?



## Try This!

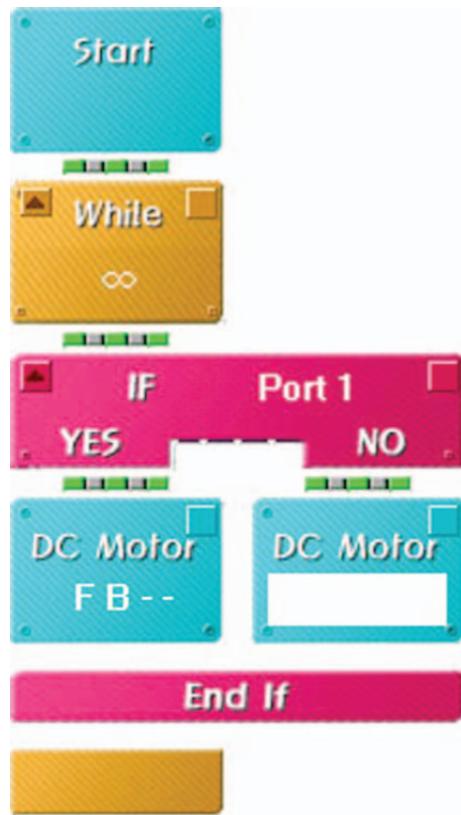
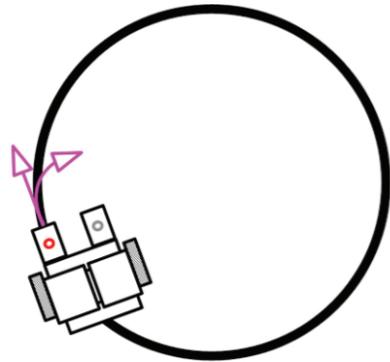
When the sensor 1 detects white and 2 detects black, insert the chip to Port1's YES → Port2's NO. How should the robot move?



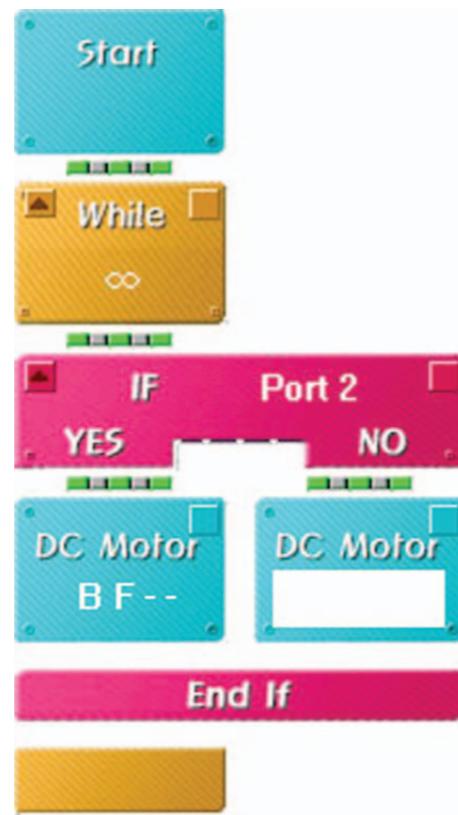
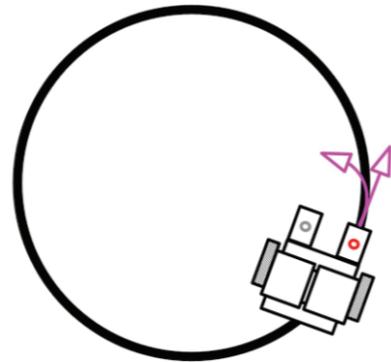
# Shall we make it move?

# TurtleBot

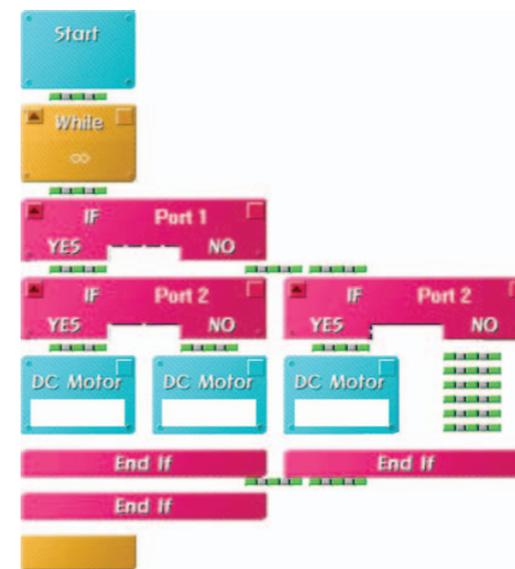
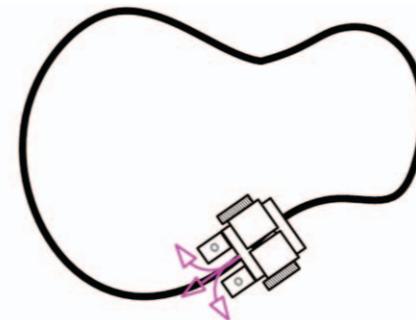
1 Use only left Infrared Sensor Board of Robot to not sheer off the black line.



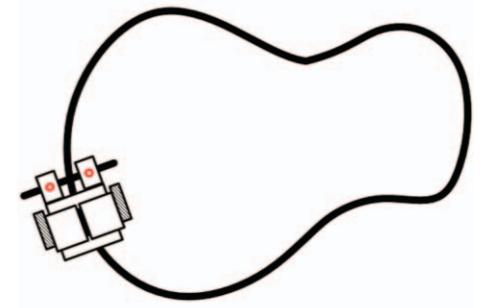
2 Use only right Infrared Sensor Board of Robot to not sheer off the black line.



3 Use only both Infrared Sensor Boards to drive on the black line.



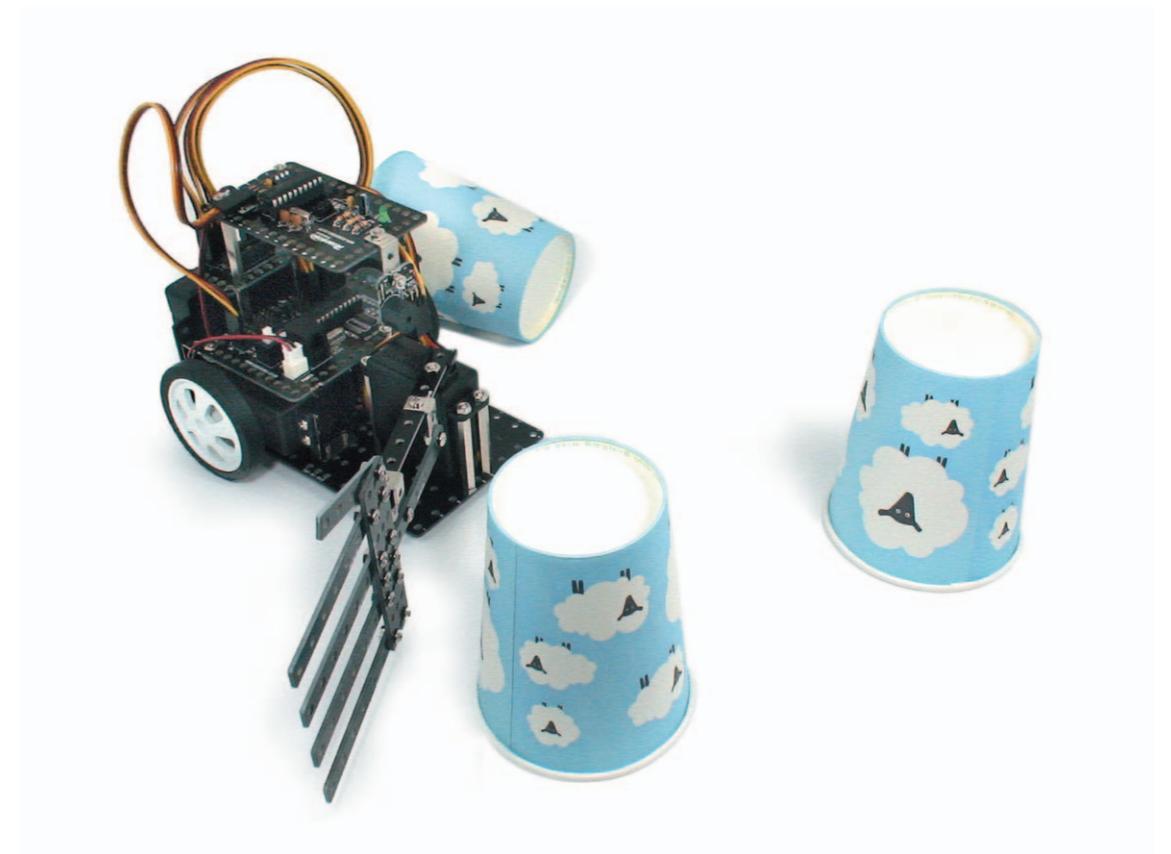
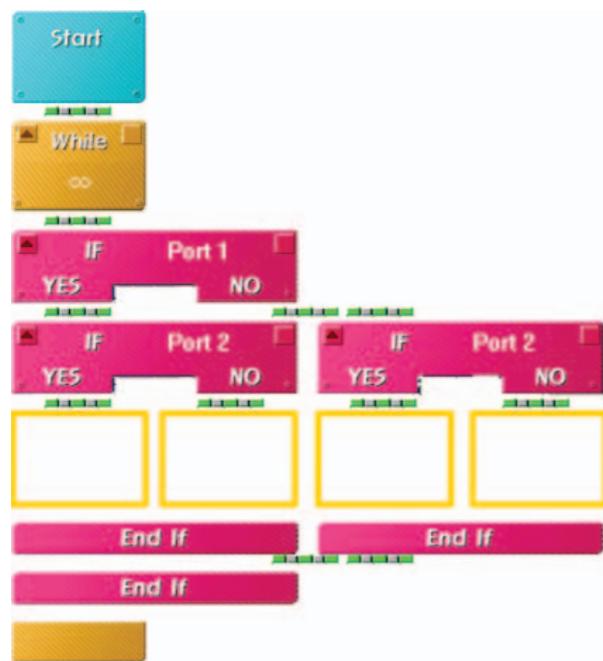
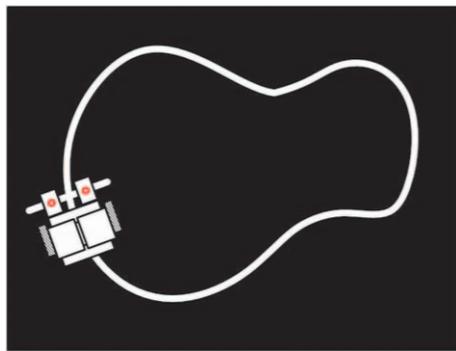
4 Compete who drives the fastest on black line. (But, make it stop on a the finish line.)



# What did you learn?

# Work of the Day

1. Make your robot drive along the white line on the black background.  
(But, make it stop on the finish line.)



**ServoBot** is a robot that clears away a thing using the Servo Motor. The Servo Motor is the one that used for a printer or a fax that is required to control exact location by an order unlike a fan or a mixer. Learn about the Servo Motor Chip and contest compete who clean the most obstacles at high speed!

.....  
▶ Servo Motor : motor that accurately controls rotating location

Teacher's Evaluation and Task	Teacher's Confirmation

• • • Servo Motor • • •



Generally, Servo Motor is a word to call a motor that is used in Servo machines. Originally Servo comes from a word 'Slave', that is named because a Servo Motor machine has moved as one is instructed. This word made its first appearance in the automatic control field in 1834. Compared to the general motor, the Servo Motor is produced to control rotating location and speed of motor more accurately.

The Servo Motor is commonly called as 'RC Servo Motor' and it is developed for steering wheel equipment of RC Car. General DC Motor can control the speed but the Servo Motor can move when wanted angle is set. Also the DC Motor can move right and left freely but, Servo Motor has limitation of moving between 0 to 180 degrees.

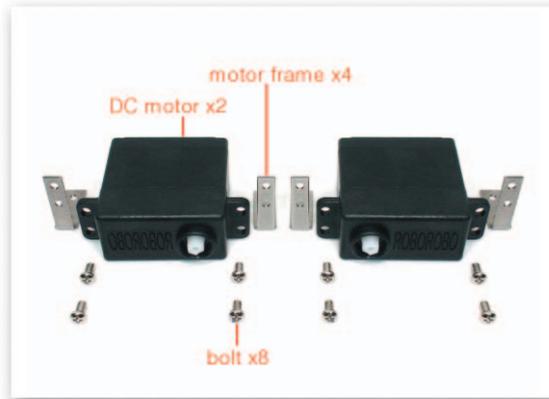
The CPU Board sends a signal to the Servo Motor to move at a specific angle and then the Servo Motor detects the signal and moves at the specific angle. The Servo Motor is easy to handle even for beginners so it is popular for RC Car, Wireless Control Plane, Walking Robot maniacs.

The outside of the Servo Motor is composed of a driving axle, a case, a lead cable and a connector, and the inside of the Servo Motor includes a gear box, a motor, and a position reaction circuit. Gear ratio of internal gear box is high enough so Servo Motor can lift up heavy goods or move difficult steering. Walking Robot can walk with a heavy battery or a computer thanks to the Servo Motor's gear box. But the Servo Motor consumes as much battery as releasing strong power. It is same principle that we get hungry easily after tough exercises.

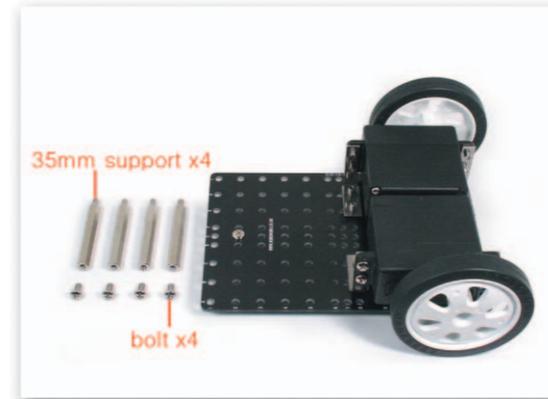


# How to Assemble

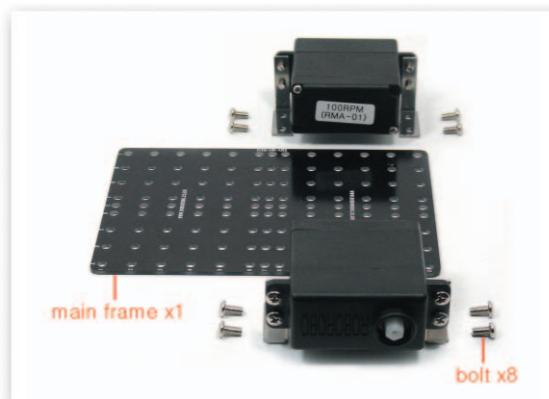
# ServBot



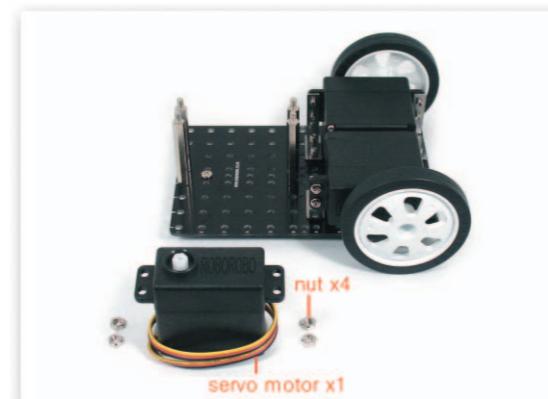
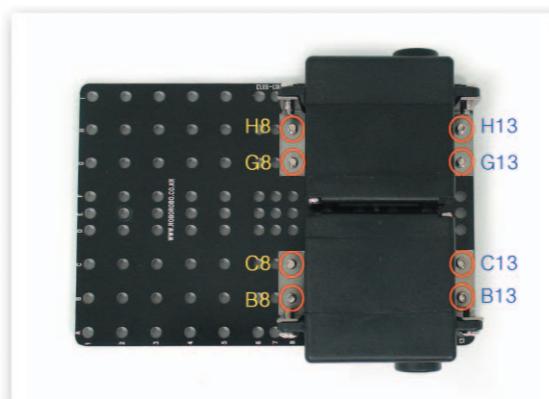
1 Fix the DC Motor and the Motor Frame using only bolts.



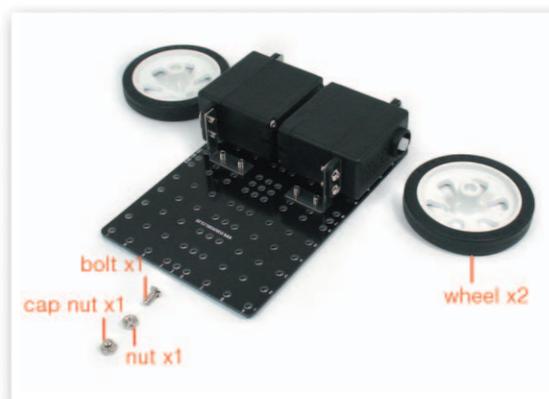
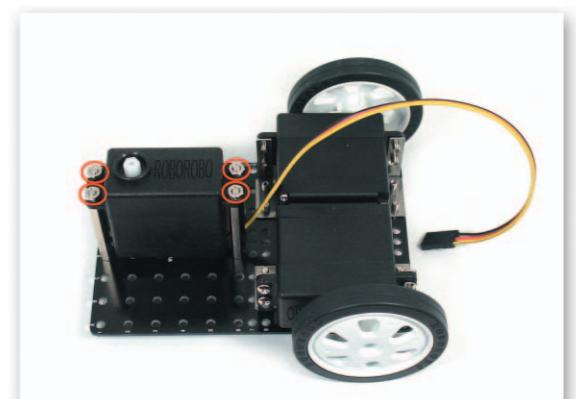
4 Fix the 35mm Support to the Main Frame with bolts.



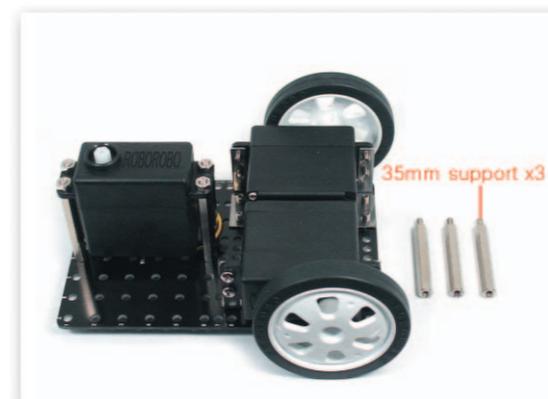
2 Put the Motor Frame that is fixed to the DC Motor to the Main Frame and fix using only bolts.



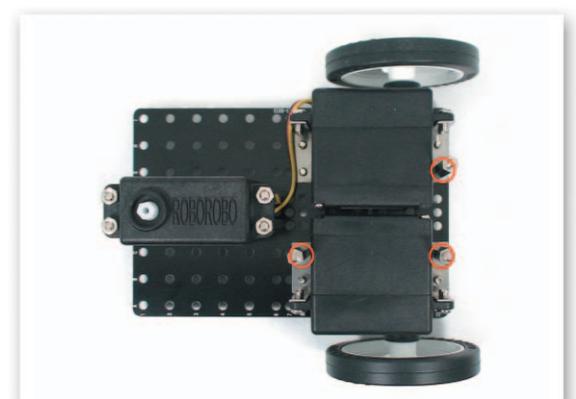
5 Insert the Servo Motor to the 5mm Support and fix with nuts.



3 Insert a bolt to the Main Frame, fix with a nut and a cap nut and then insert wheels to the DC Motor axle.

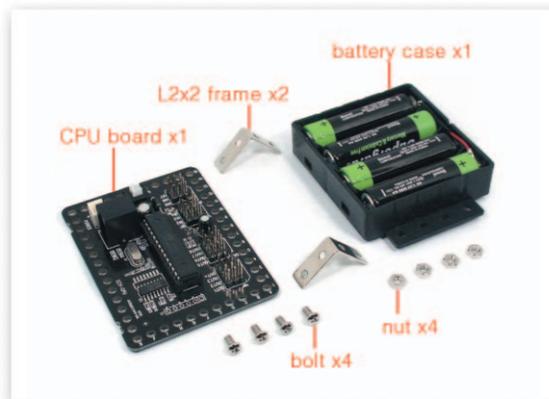


6 Twist-insert the 35mm Support on a bolt that is used to fix the Motor Frame on the Main Frame.

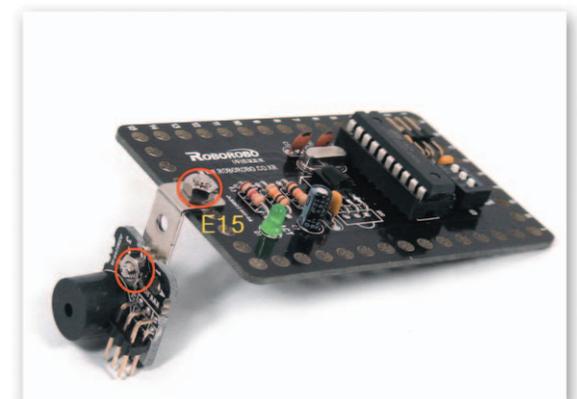
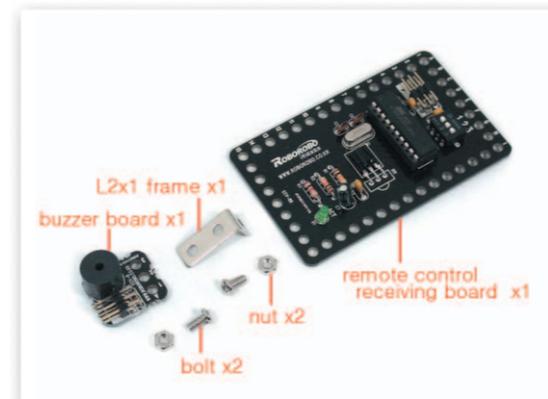


# How to Assemble

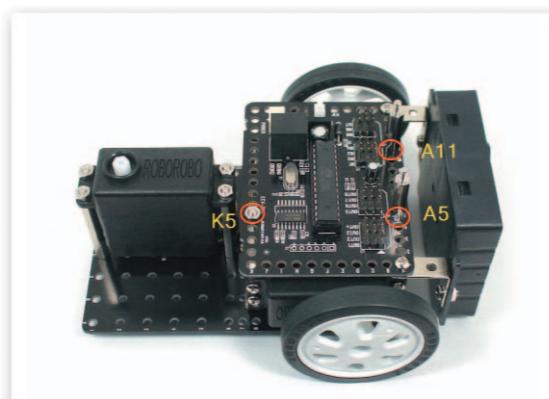
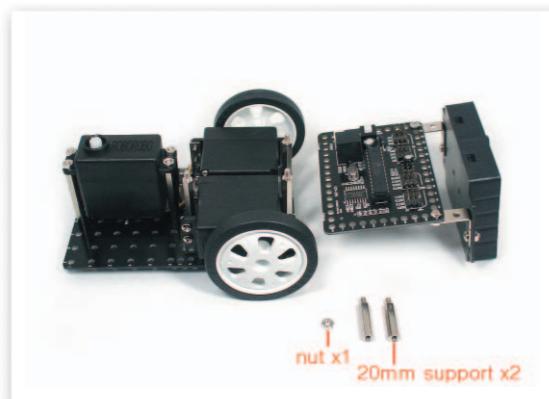
# ServBot



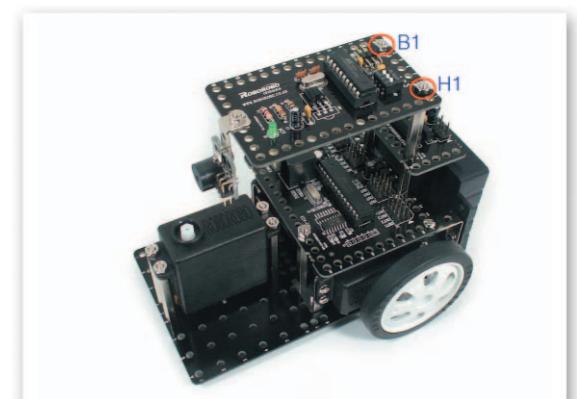
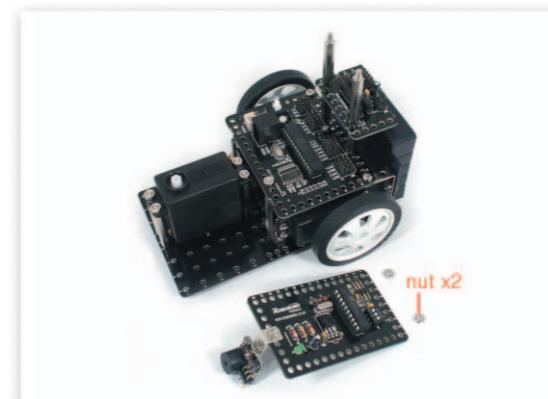
7 Connect the Battery Case and the CPU Board with the L-type 2x2 Frame.



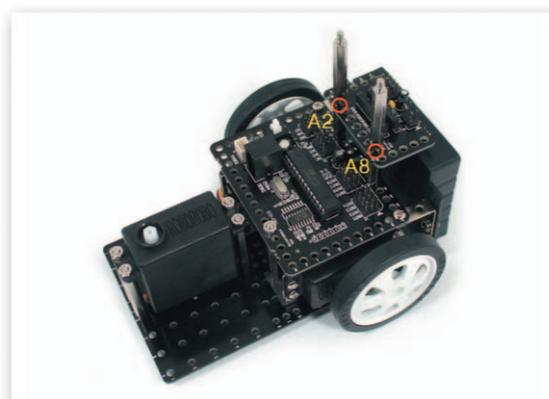
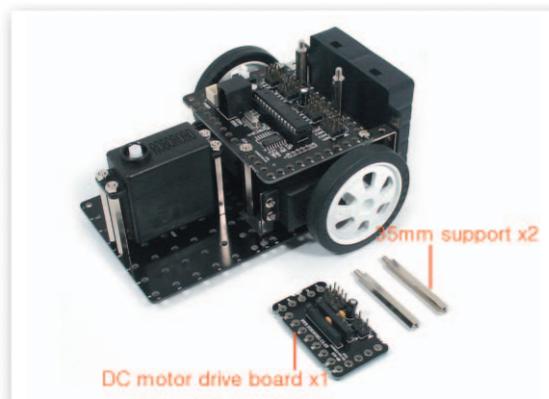
10 Connect the Remote Control Receiving Board and the Buzzer Board with the L-type 2x1 Frame.



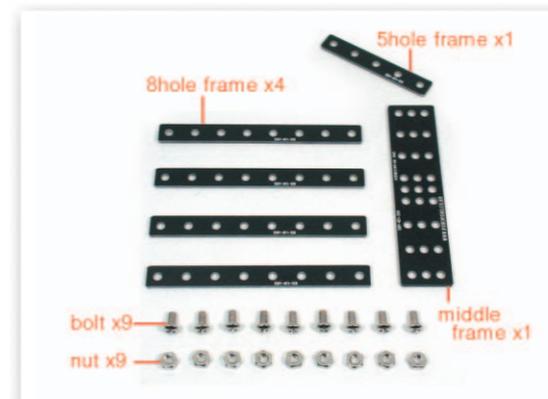
8 Insert the CPU Board to the Support that is fixed to the Main Frame then fix with the 20mm Support and a nut.



11 Insert the Remote Control Receiving Board to the Support that is fixed to the DC Motor Drive Board and then fix with nuts.



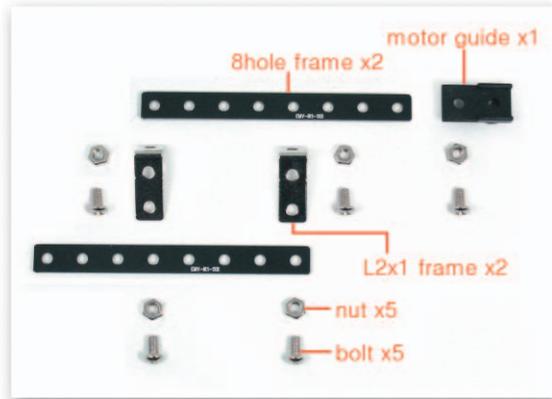
9 Insert the DC Motor Drive Board to the Support that is fixed to the CPU Board then fix with the 35mm Support.



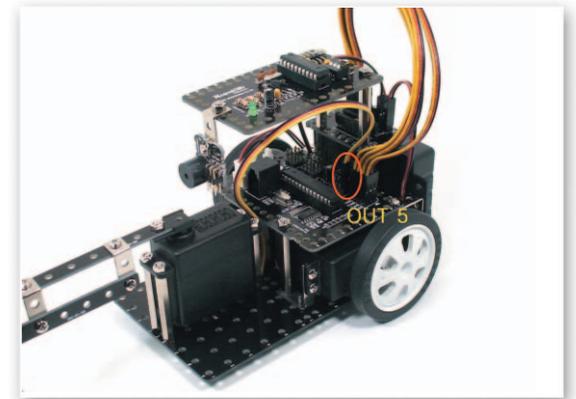
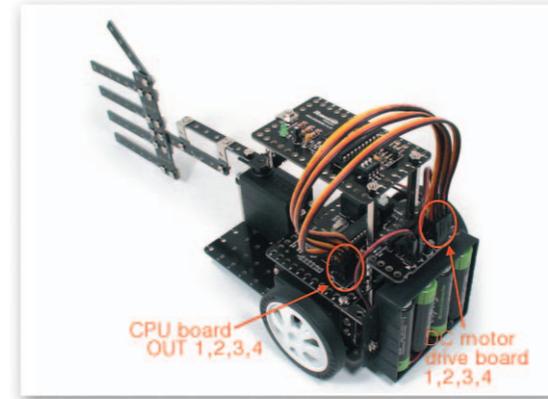
12 Fix the Small 8 Frame and the Small 5 Frame to the Middle Frame with bolts and nuts and make a shape of a hand.

# How to Assemble

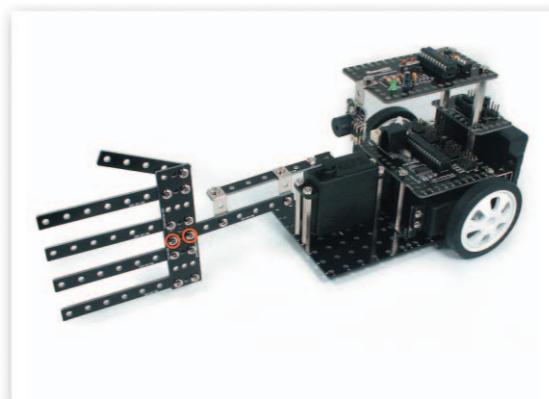
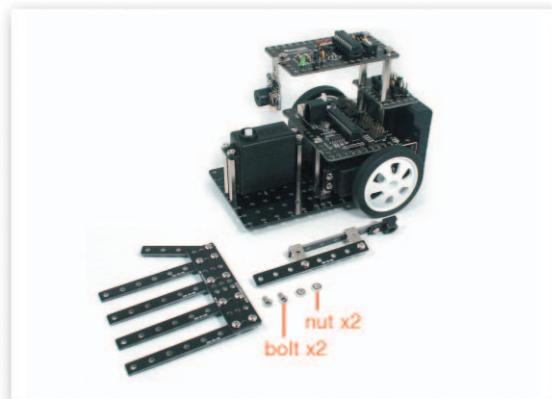
# ServBot



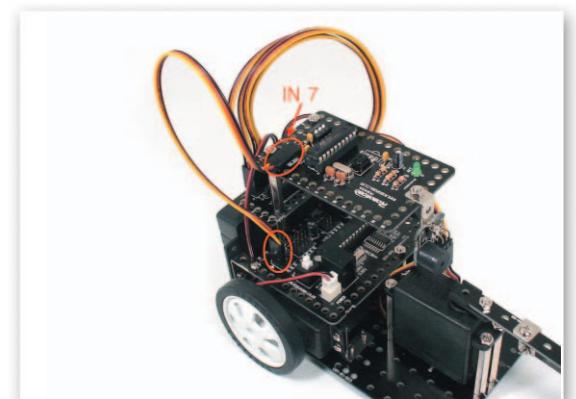
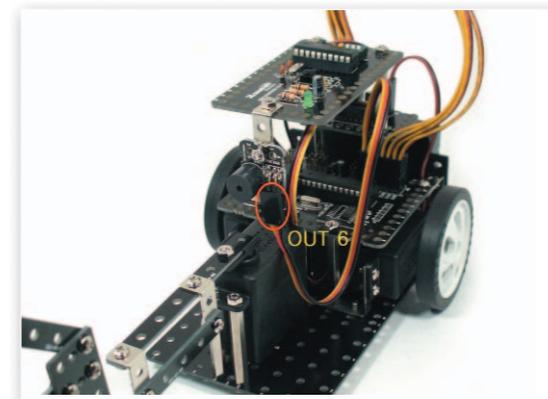
13 Connect 2 the two Small 8 Frames with the L-type 2x1 Frame and then fix the Motor Guide to the Small 8 Frame.



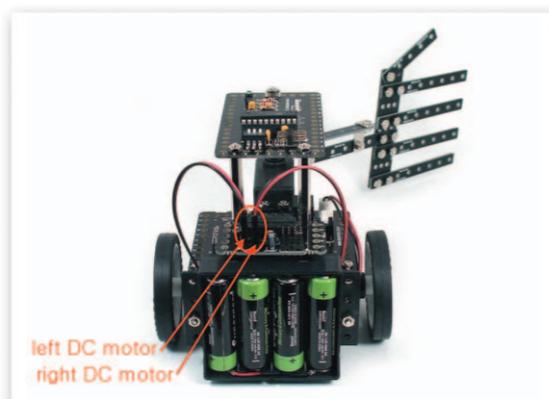
16 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and 1, 2, 3, 4 of the DC Motor Drive Board. Connect the Servo Motor Cable to OUT Port 5 of the CPU Board.



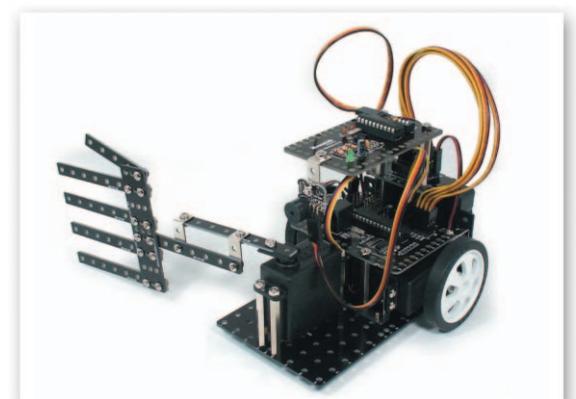
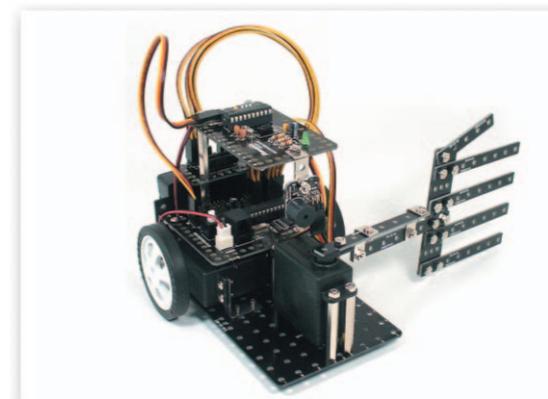
14 Connect the hand-shaped Middle Frame and the Small 8 Frame with bolts and nuts and then insert the Motor Guide to the Servo Motor axle.



17 Connect the 3 Pin Cable to OUT Port 5 of the CPU Board and the Buzzer Board. Connect the 3 Pin Cable to IN Port 7 of the CPU Board and the Remote Control Receiving Board.



15 Connect the Power Cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to A, B of the DC Motor Drive Board.



18 Completed ServoBot.

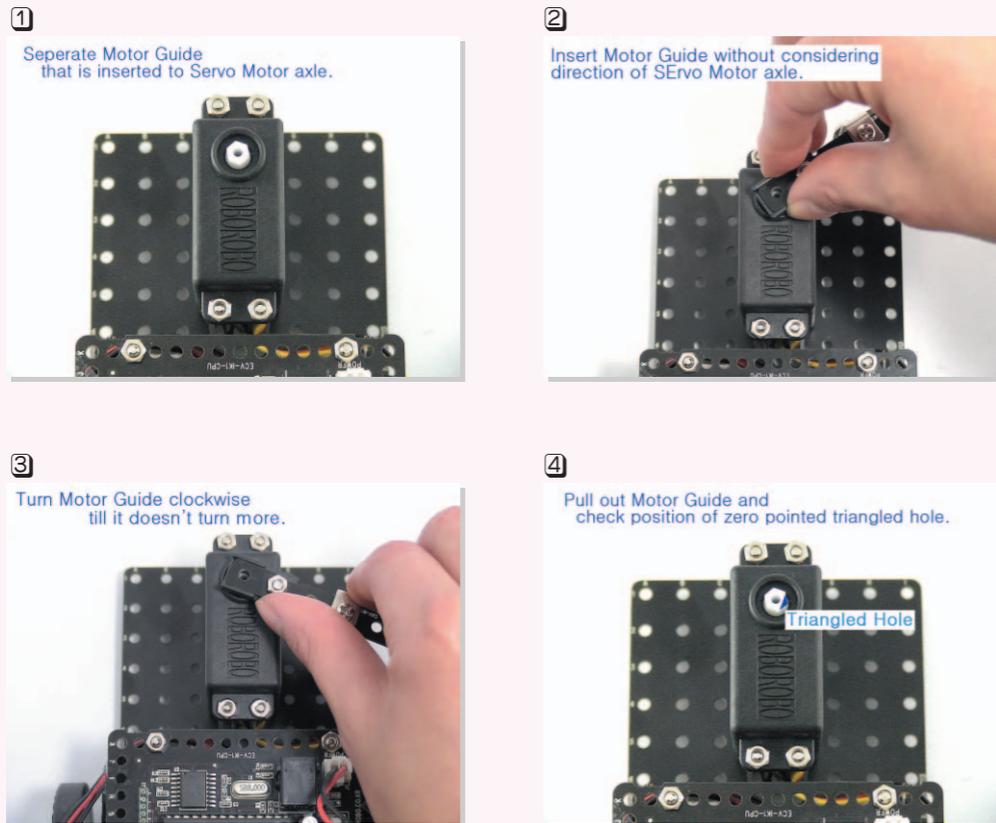
# Explain the Program

## Set the Zero point of the Servo Motor

- Main Function : Set zero point of the Servo Motor.
- Application : Insert the Motor Guide to the Servo Motor axle and then turn the Motor Guide clockwise till the end.

### Try This!

Set the zero point of the Servo Motor using the Motor Guide.

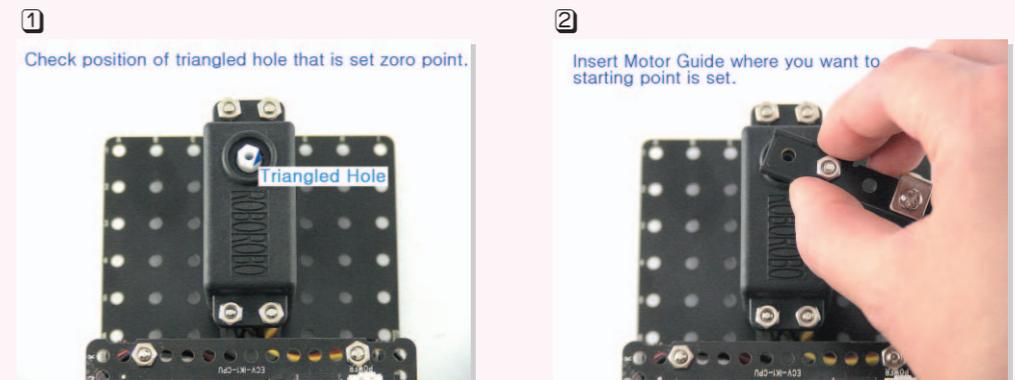


## Set the Starting Point of the Servo Motor

- Main Function : Set the starting point of the Servo Motor.
- Application : After read a radius of rotation to move in the condition of finding zero point, insert the Motor Guide to a position to start.

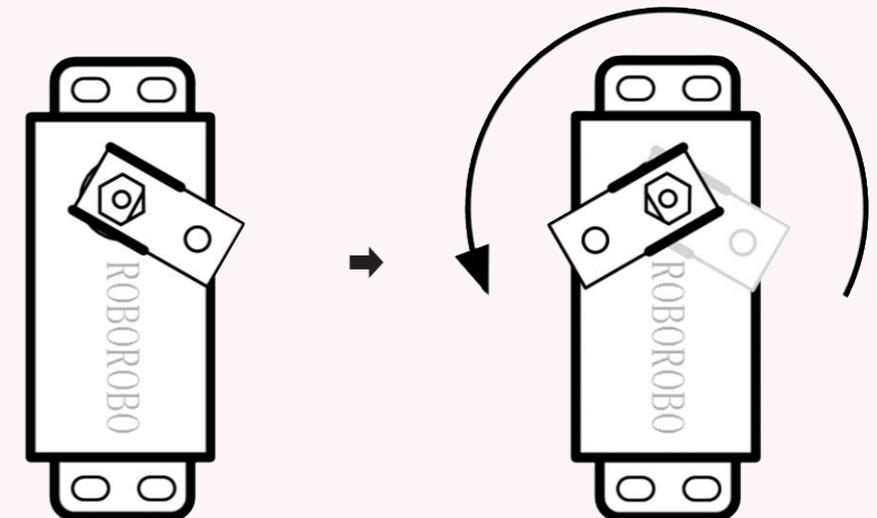
### Try This!

Set the starting point of the Servo Motor using the Motor Guide.



### Try This!

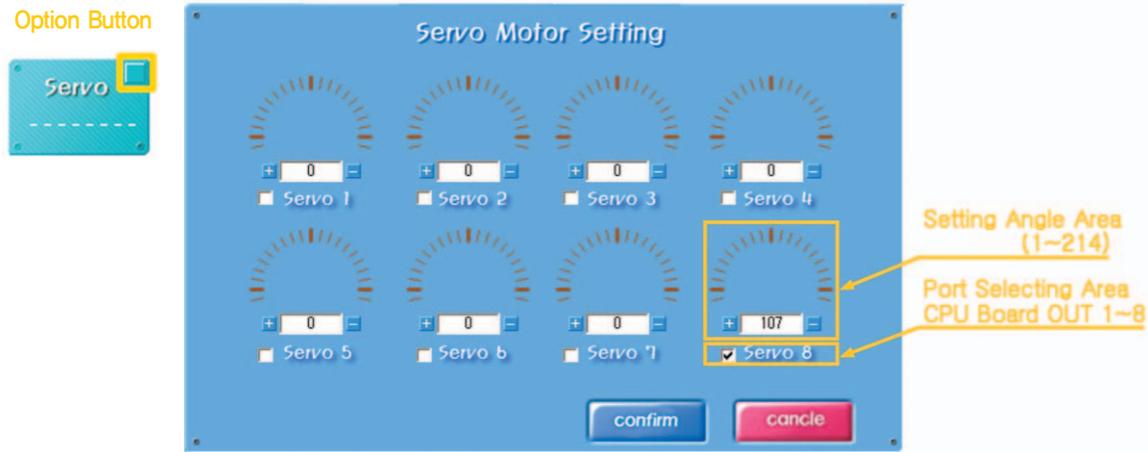
Turn the Motor Guide by the hand and check the radius of rotation of the Motor Guide.



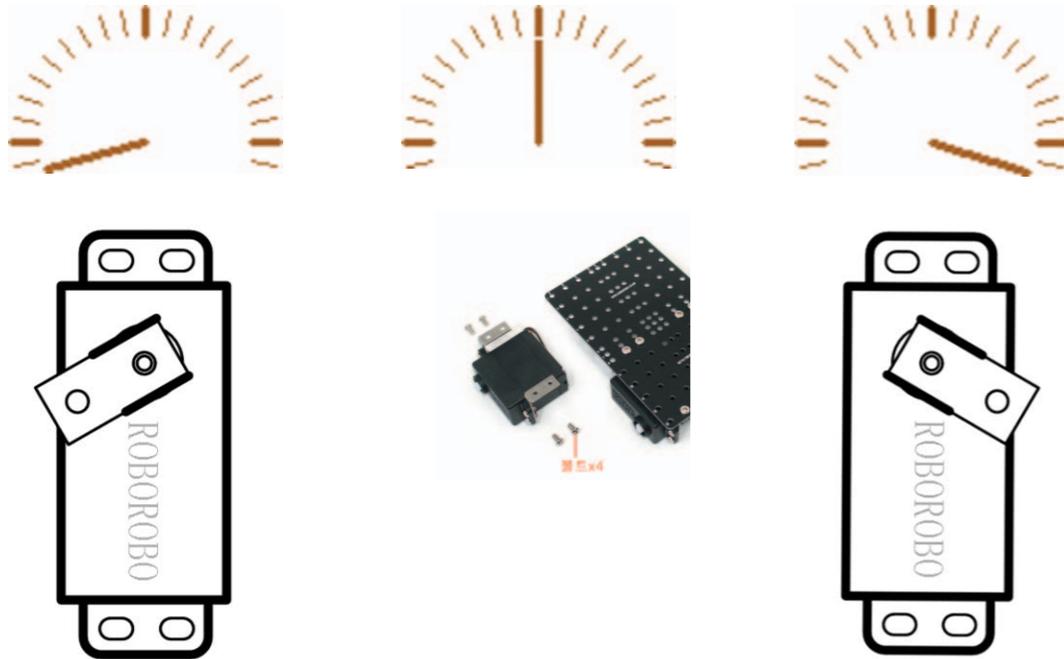
# Explain the Program

## Servo Motor Chip

- Main Function : It sets a radius of rotation of the Servo Motor.
- Application : Check OUT Port of the CPU Board that is connected with the Servo Motor and set the radius of rotation among 1~214.



- Setting Area of the Radius of Rotation and Angle of the Motor Guide (When angle of starting point is 1)



## Try This!

Set a the starting point after setting the zero point of the Servo Motor using the Servo Motor Chip.

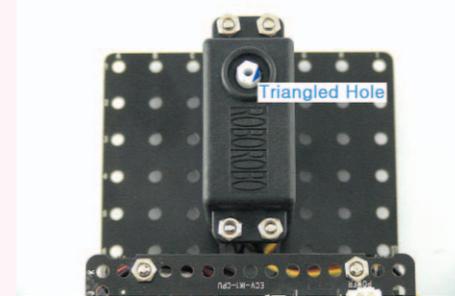
①

Select Servo 5 and set the rotating position to 1.



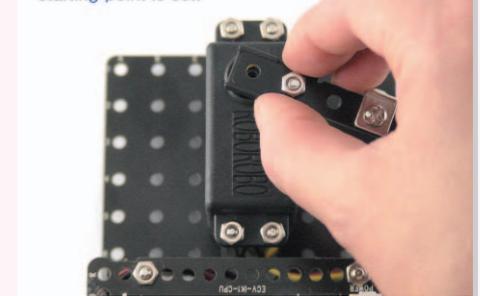
②

Check position of triangled hole that is set zero point.



③

Insert Motor Guide where you want to starting point is set.



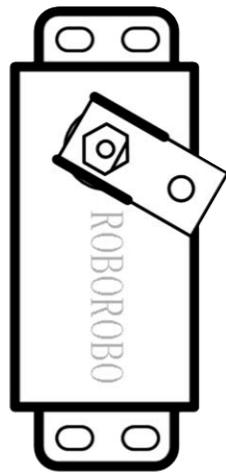
# Explain the Program

# ServBot

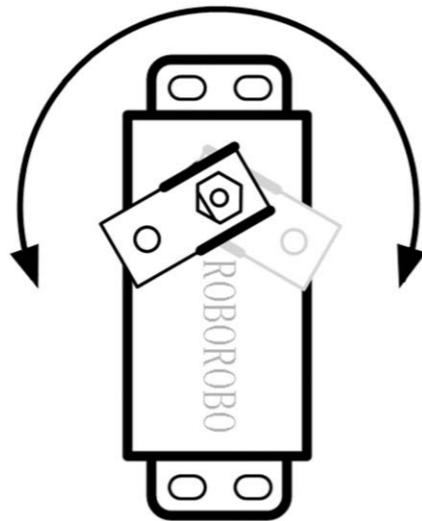
## Set the Server Motor

- Main Function : Setting the starting point and rotating position.
- Application : After set the zero point then insert the Motor Guide to setting position and set the rotating position with the Servo Motor Chip.

[Setting Position of the Starting Point]

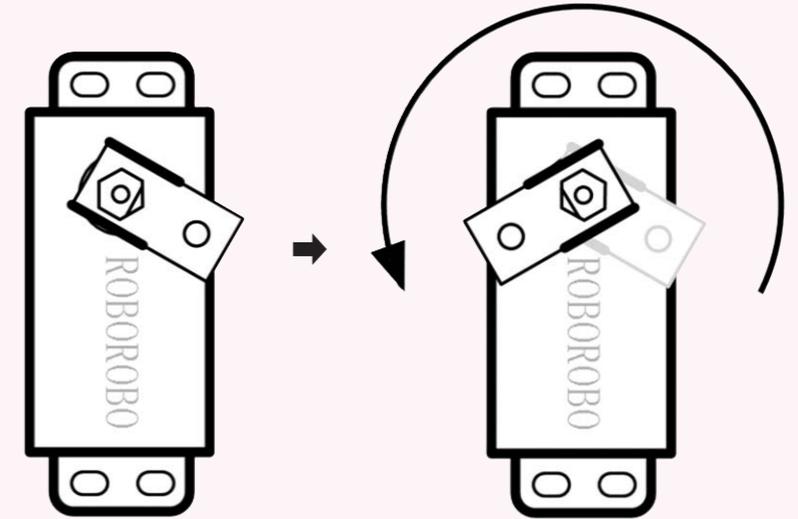


[Radius of Rotation]



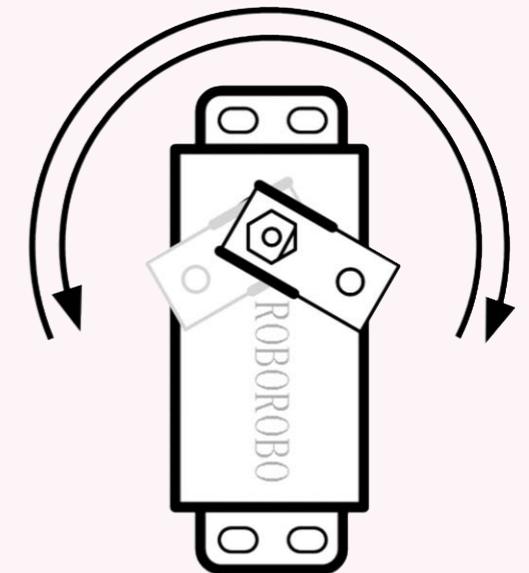
### Try This!

Turn the Motor Guide from end of clockwise to end of anti-clockwise.



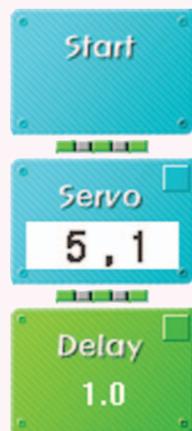
### Try This!

Turn Motor Guide from end of clockwise to end of anti-clockwise then turn it back to where it was.

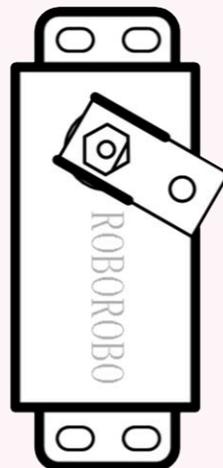


### Try This!

Check the starting point using the Servo Motor Chip.



OUT Port 5, Angle 1





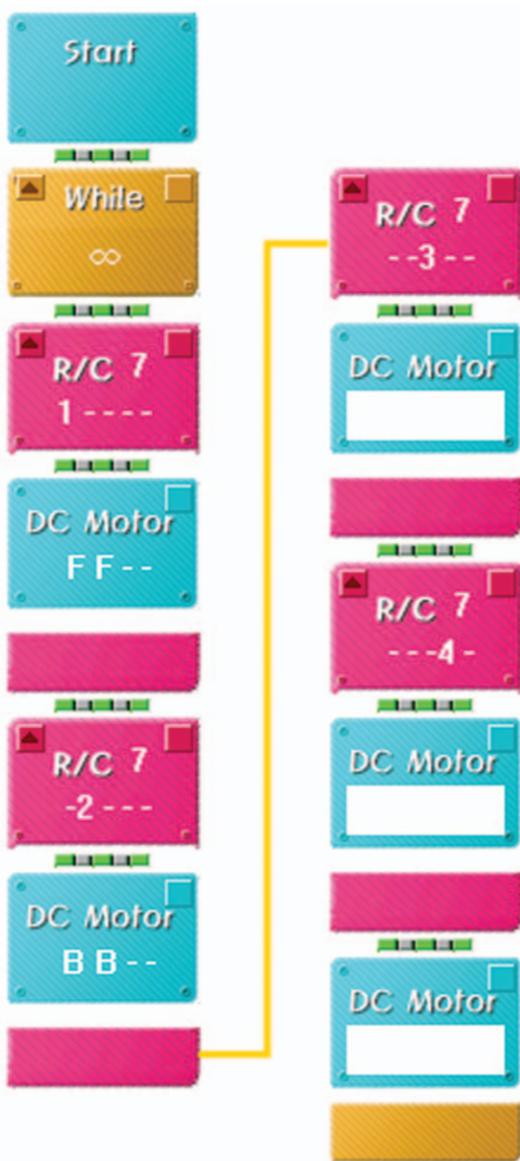
# Shall we make it move?

# ServBot

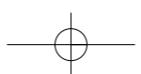
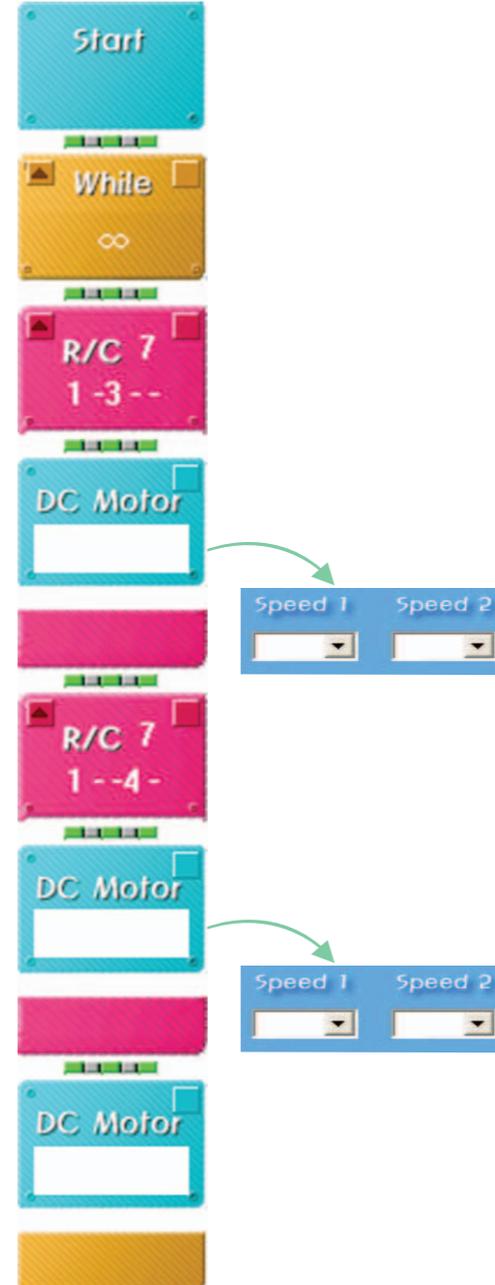
1 Try to remove the obstacle Servo Motor when pressing 5 of the Wireless Remote Control.



2 Try to move the robot forward when pressing 1 of Wireless Remote Control, move backward with 2, turn left with 3 and turn right when pressing 4.



3 Try to turn left while moving forward when pressing 1, 3 of Wireless Remote Control and turn right while moving forward with 1, 4.



# What did you learn?

1. Find a right component with an explanation.

Component that controls wirelessly in a distance of the machine



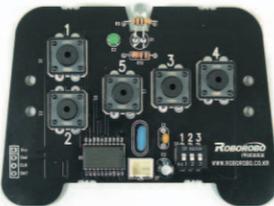
Component that distinguishes black and white for thing's presence



Component that controls the position accurately and used in a printer or fax



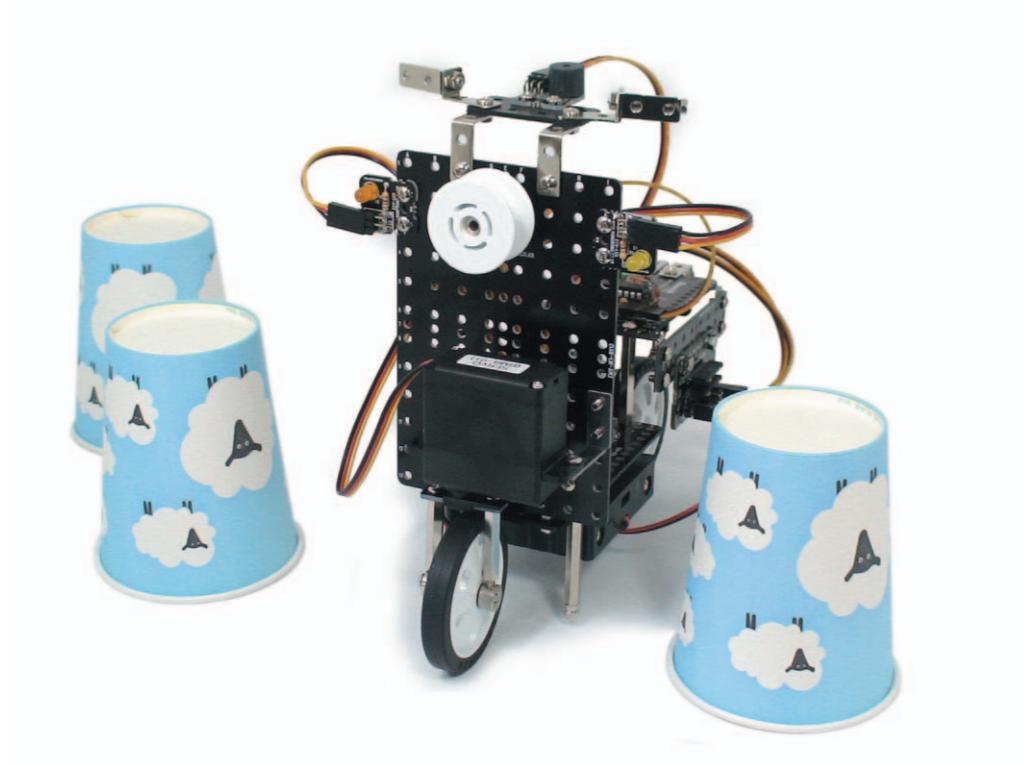
Component that makes a robot possible to drive on uneven dirt road



Teacher's Evaluation and Task

Teacher's Confirmation

# Work of the Day

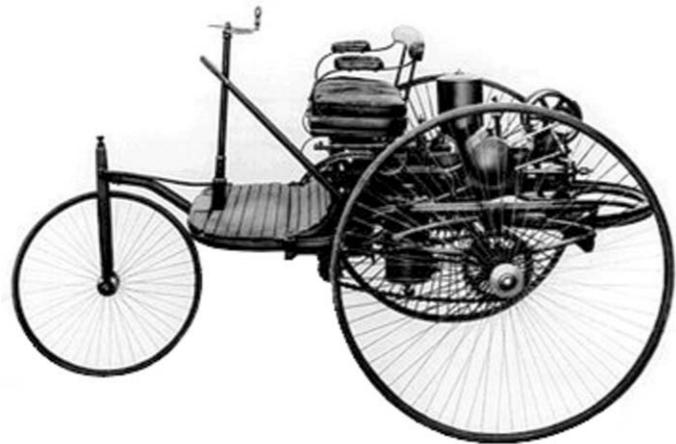


**ScooterBot** is a robot that drives using Servo Motor as a steering system.

The Front Servo Motor changes its direction with a front wheel and the rear DC Motor works as a driving system like an engine. Let's learn the origin of the steering system and have a race of going through paper cups without touching them and see who arrives the fastest using the Wireless Remote Control.

- ▶ Scooter : a small light motorcycle with two wheels
- ▶ Steering System: equipment that changes a radius of rotating direction of front wheel to change course

### • • • History of Steering System • • •



A general robot controls the rotating direction or rotating speed of a motor that is connected to wheels to change courses. For example, If you stop the left wheel and let the right wheel move forward, the robot makes left turn. On the contrary, If you let the left wheel move forward and stop the right wheel, the robot makes right turn. Excavators and tanks those use caterpillars instead of wheels also change the direction in this way.

However, when you observe specifically cars, buses and so on you can figure out that the front wheel rotates changing its direction. Thus the equipment changing direction of the wheel is called Steering System.

The car that Daimler and Benz of Germany was invented in 1886, had a handle of a bicycle. 10 years later from then, *Drake*, the bicycle engineer Drake of in England, invented the pivot-type handle that turns a whole front wheel and a wheel axle but it had frequent troubles because of the bad cushion.

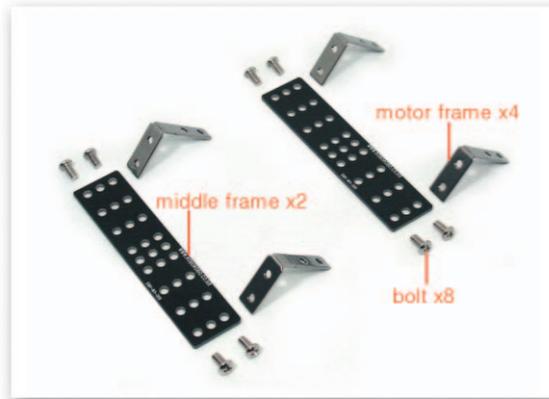
The modern handle that two front wheels can change direction is observed by Lanken *Sperger* of Germany in 1898. One late spring afternoon, he saw a water mill on the way to go to a picnic with his wife. He got an idea from a mortar which was moved up and down by a moving water mill and designed the handle. However he could not secure a patent due to his poverty. With no money, he usually bought books on credit so when he was pressed for payment, he could not but give the draft to *Rudolph Ackerman*, the owner of bookstore with no choice. Later Ackerman discovered the worth of this design and secured a patent with his name and sold producing rights. This handle is the one called as Ackerman-type handle which became an origin of a current car handle. However this was not a round wheel-type handle but connecting threads within both wheels to steel stick that looks like a bicycle handle to change direction. It was not a real product until Charles Jantaud, French engineer, made the handle round.

The handle of that time was mechanical and it should be turned with human force which required more power on a heavier car. From then using the principle of hydraulic automatic door that Mercedes Benz has developed in 1946, Chrysler Corporation of America made the Power Steering that is the semiautomatic handle in 1952. With appearance of the semiautomatic handle, the mechanical handle had gradually disappeared from the history of handles.

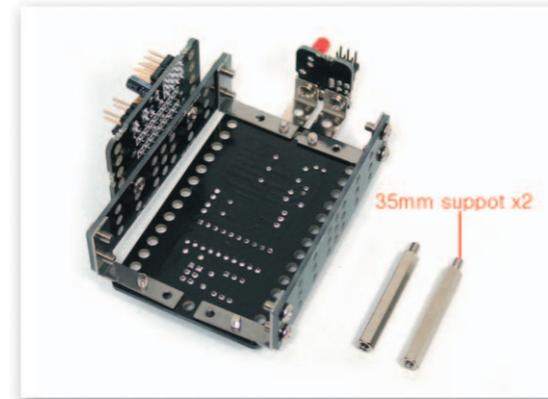


# How to Assemble

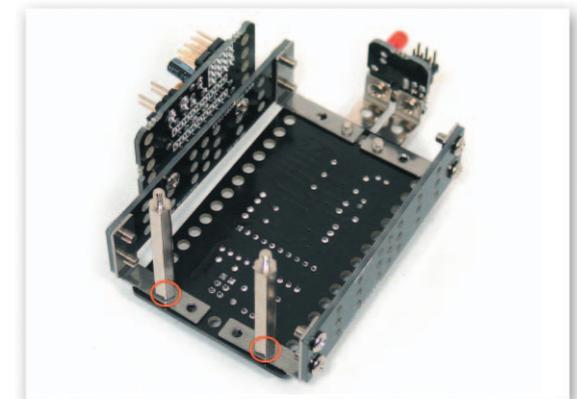
# ScooterBot



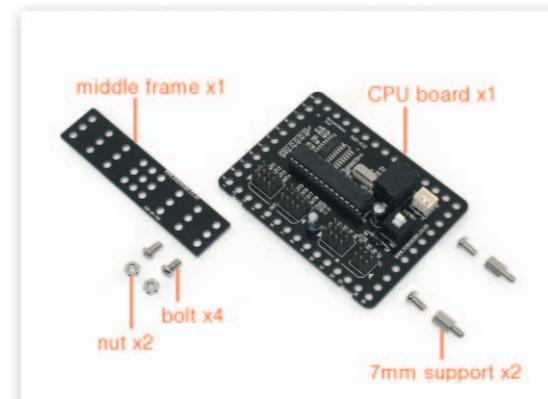
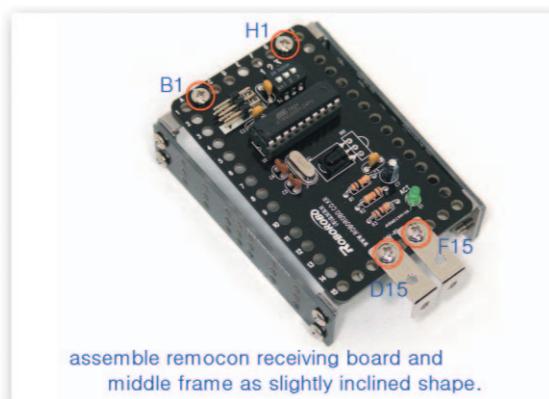
1 Put the Motor Frame on the Middle Frame and fix with bolts.



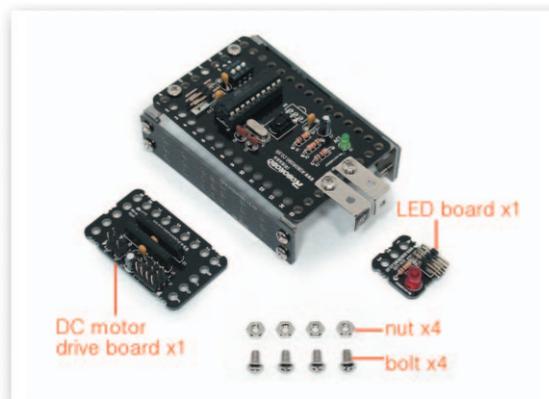
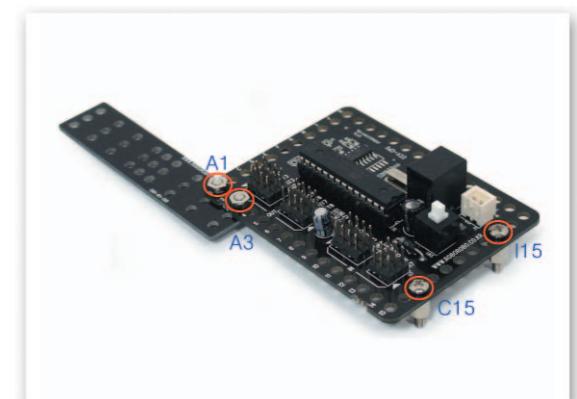
4 Twist-insert the 35mm Support on bolts that fixed the Motor Frame.



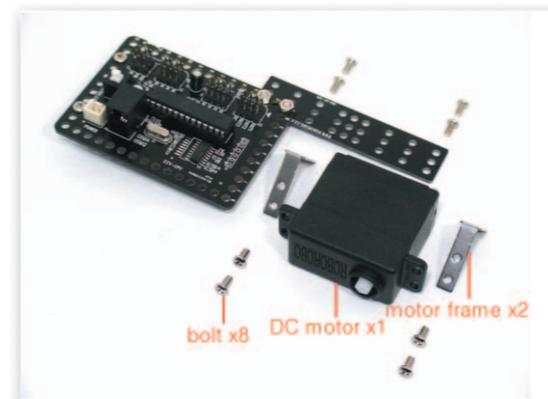
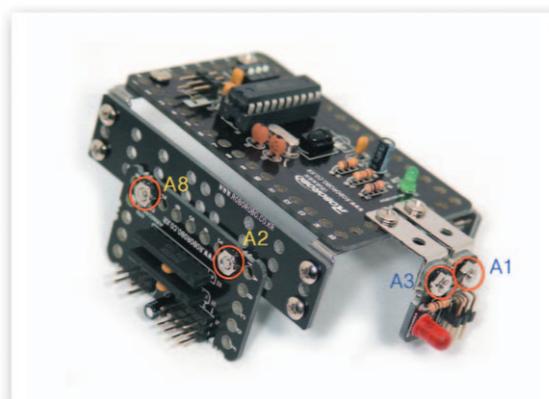
2 Fix the L-type 2x1 Frame and the Motor Frame that is connected to the Middle Frame to the Remote Control Receiving Board with bolts.



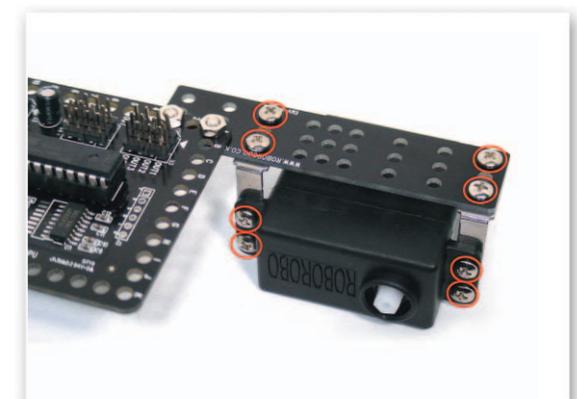
5 Fix the 7mm Support to the CPU Board with bolts and then put the Middle Frame under the CPU Board and fix with bolts and nuts.



3 Fix the DC Motor Drive Board and the LED Board to the Middle Frame and the L-type Frame each with bolts and nuts.

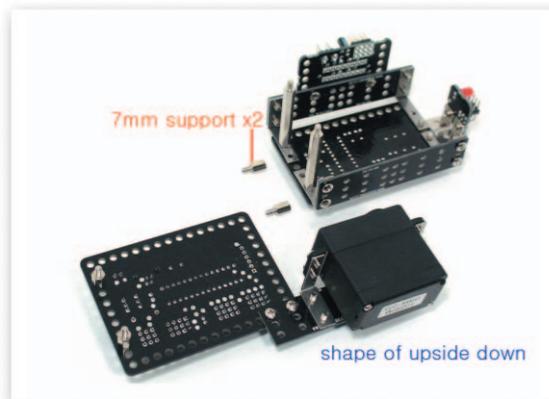


6 Fix the Motor Frame to the DC Motor with bolts and then fix it to the Middle Frame using bolts.

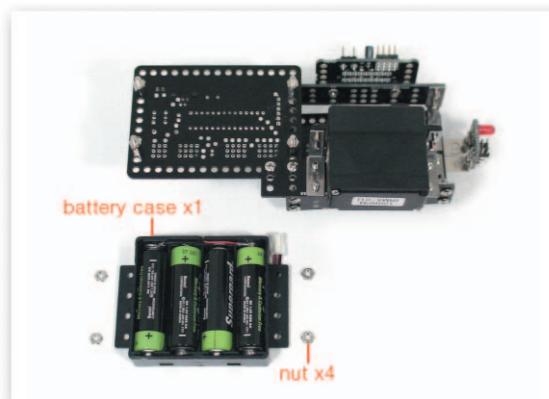
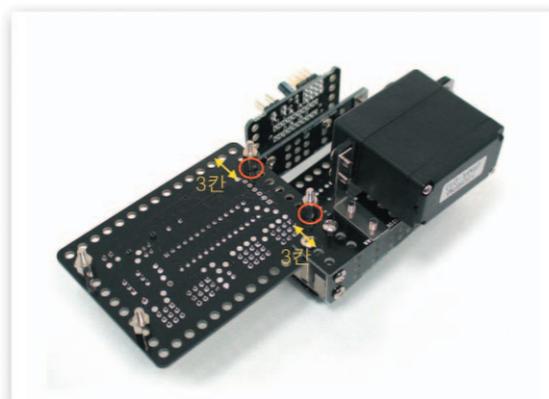


# How to Assemble

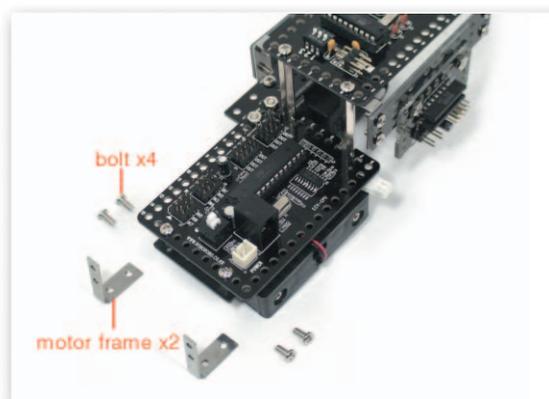
# ScooterBot



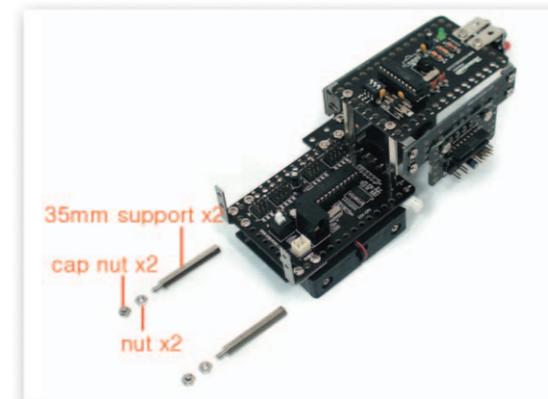
7 Insert the CPU Board to the Support that is fixed to the Remote Control Receiving Board then fix with the 7mm Support.



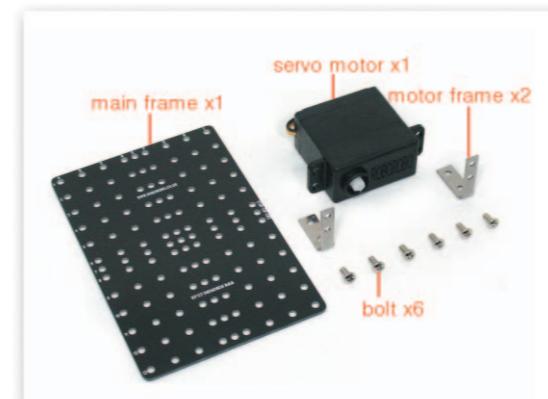
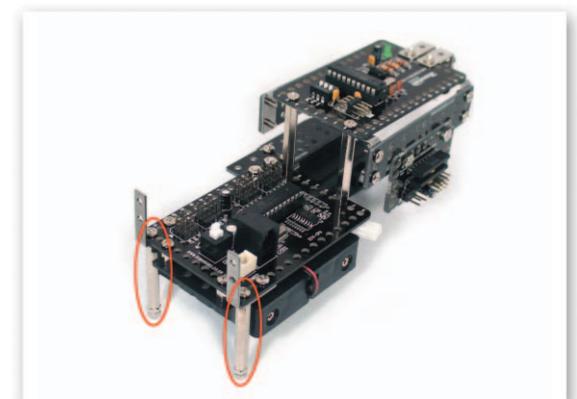
8 Insert the Battery Case to the Support that is fixed to the CPU Board and then fix with nuts.



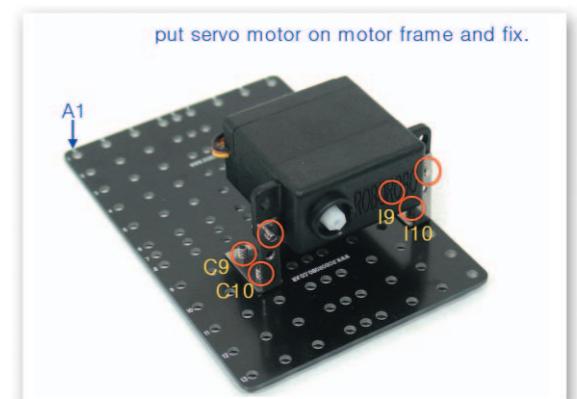
9 Put Motor Frame under CPU Board and fix with bolts.



10 Insert the 35mm Support to bolts that is fixed to the CPU Board and then fix nuts and cap nuts.



11 Connect the Motor Frame to the Servo Motor with bolts and then fix to the Main Frame with bolts.



12 Insert the Caterpillar Wheel Guide to the 3x10 Bolt then fix by tightening bolts. Fix the LED Board to the Main Frame with bolts and nuts.



# How to Assemble

# ScooterBot



13 Fix the Main Frame to the Motor Frame that is fixed to the CPU Board by using bolts.



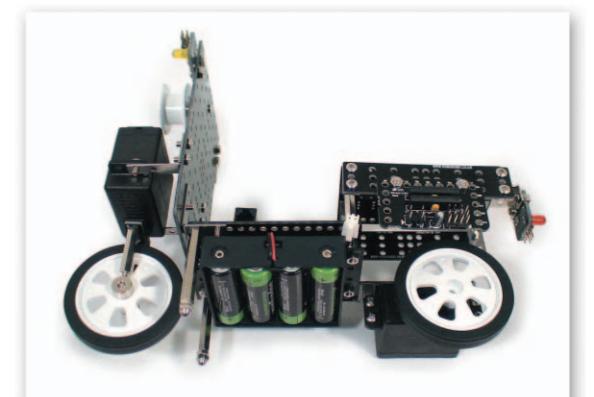
16 Insert the 7mm Support that is fixed to the Wheel first and then fix the regulable bolt on the other side with the 3x10 Bolt.



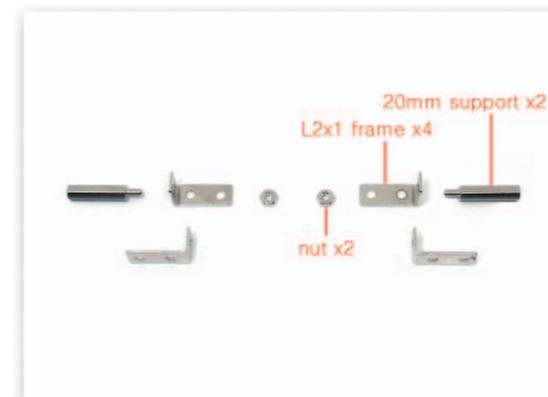
14 Insert the 5mm Support to a Wheel first then fix with the 7mm Support.



17 Insert the Motor Guide with front wheels fixed to the Servo Motor axle and insert the prepared rear wheels to the DC Motor axle.



15 Insert bolts after overlapping the Motor Guide and the Small 3 Frame and then fix with the 25mm Support. Also twist about twice and fix the regulable bolt to the 25mm Support.

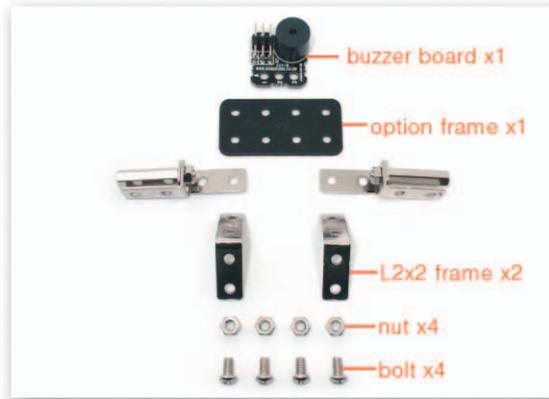


18 Overlap each 2 of the L-type 2x1 Frames cross and insert the 20mm Support then fix with nuts to make a handle.

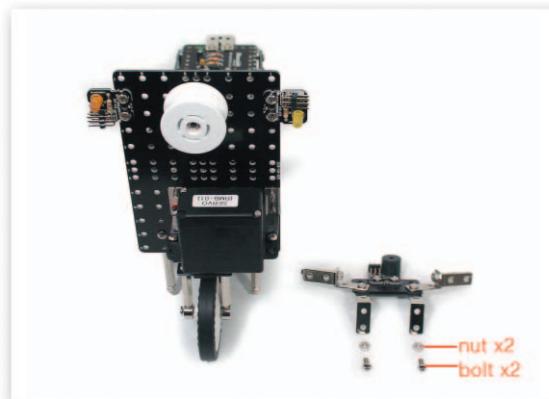


# How to Assemble

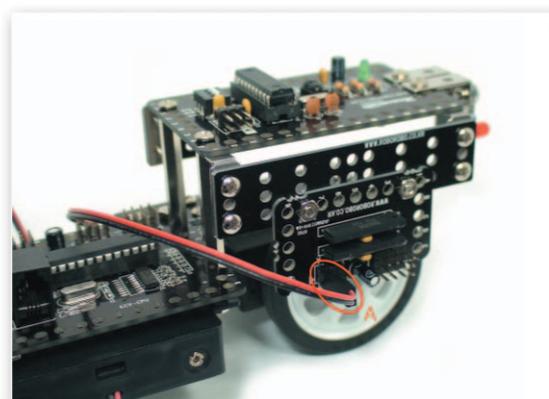
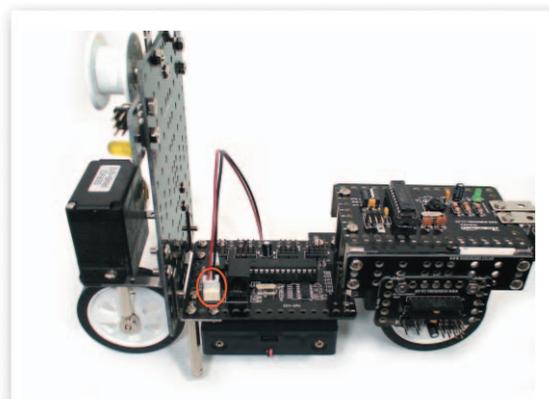
# ScooterBot



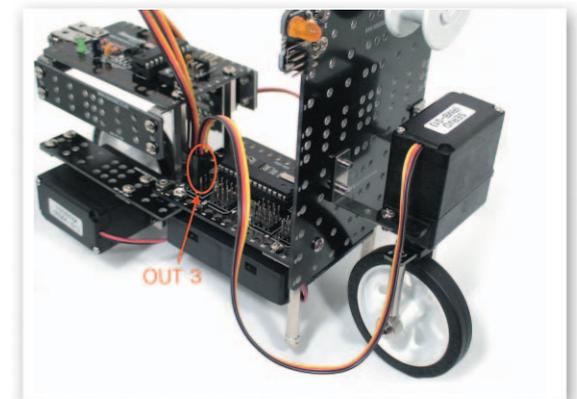
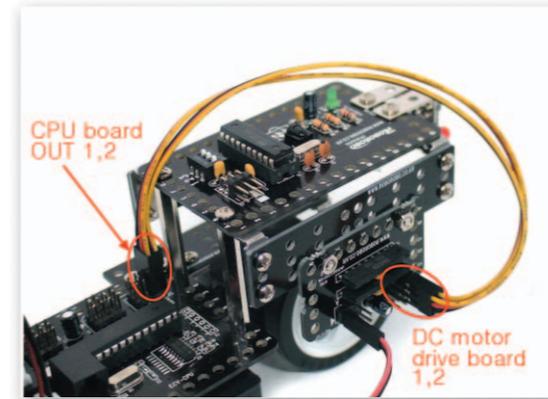
19 Fix the Buzzer Board to the Option Frame and then put Option Frame in the middle, overlap the L-type 2x1 Frame and the L-type 2x2 Frame up and down and fix with bolts and nuts to make handle parts.



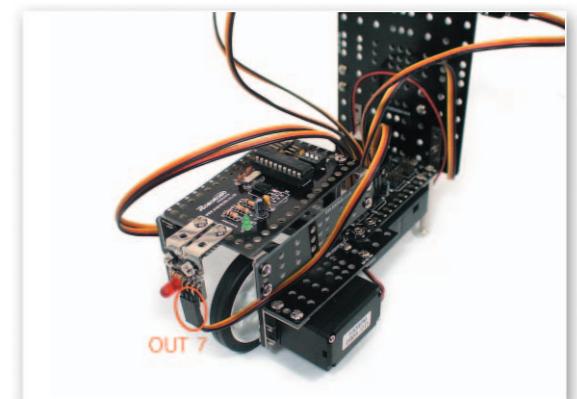
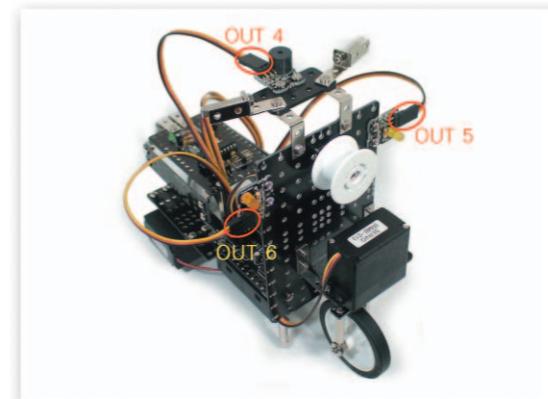
20 Fix the L-type 2x2 Frame of the Handle part to the Main Frame with bolts and nuts.



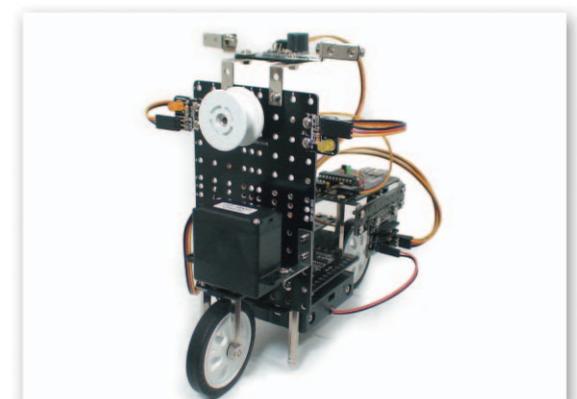
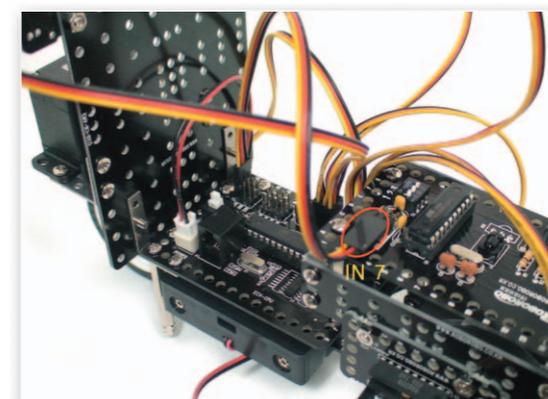
21 Connect the power cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A.



22 Connect the 3 Pin Cable to OUT Port 1, 2 of the CPU Board and 1, 2 of the DC Motor Drive Board. Connect the Servo Motor Cable to OUT Port 3 of the CPU Board.



23 Connect the 3 Pin Cable to OUT Port 4 of the CPU Board, the Buzzer Board and the LED Board. Connect the 3 Pin Cable to OUT Port 5, 6 of the CPU Board and the LED Board.



24 Connect the 3 Pin Cable to IN Port 7 of the CPU Board and the Remote Control Receiving Board. Completed ScooterBot.

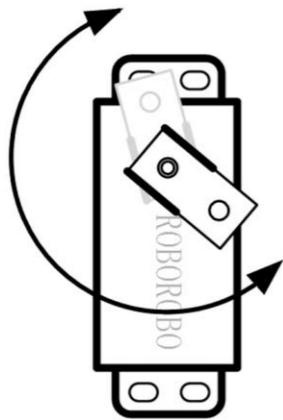
# Explain the Program

# ScooterBot

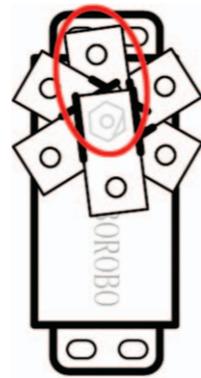
## Set the Starting Point of the Servo Motor

- Main Function : Setting the starting point of the Servo Motor.
- Application : See a radius of rotation to move with a condition of finding zero point and insert the Motor Guide to a position to start.

[Radius of Rotation]



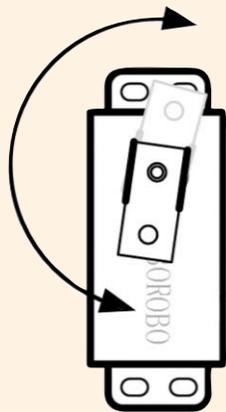
[Position of Setting the Starting Point]



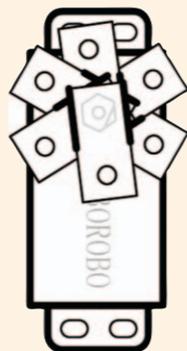
### Try This!

The rotational radius of the Motor guide which is set the zero point is as below. Draw ○ on the direction that Motor Guide should be inserted.

[Radius of Rotation]



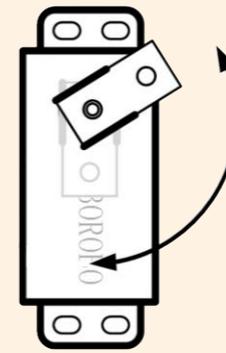
[Position of Setting the Starting Point]



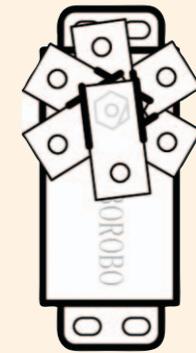
### Try This!

The rotational radius of the Motor guide which is set the zero point is as below. Draw ○ on the direction that Motor Guide should be inserted. (2)

[Radius of Rotation]



[Position of Setting the Starting Point]



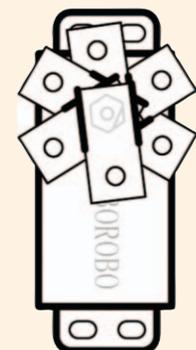
### Try This!

Guide The rotational radius of the Motor guide which is set the zero point is as below. Draw ○ on the direction that Motor Guide should be inserted. (3)

[Radius of Rotation]



[Position of Setting the Starting Point]



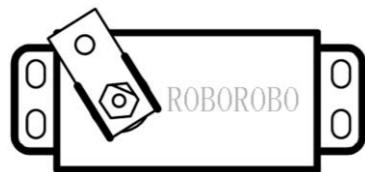
# Explain the Program

# ScooterBot

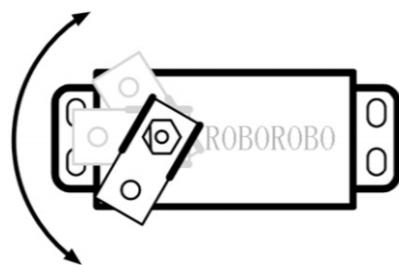
## Set th Servo Motor

- Main Function : Setting the starting point and rotating position.
- Application : Set the zero point and then insert the Motor Guide on a position of setting the starting point and set the rotating position with the Servo Motor Chip.

[Position of Setting the Starting Point]

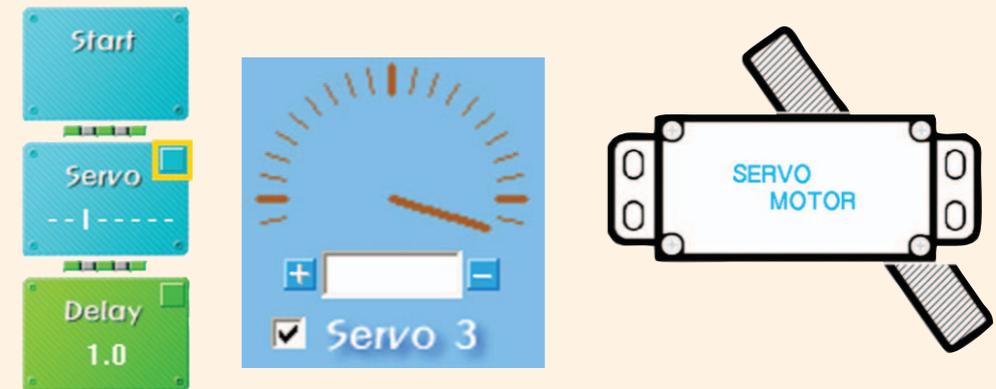


[Radius of Rotation]



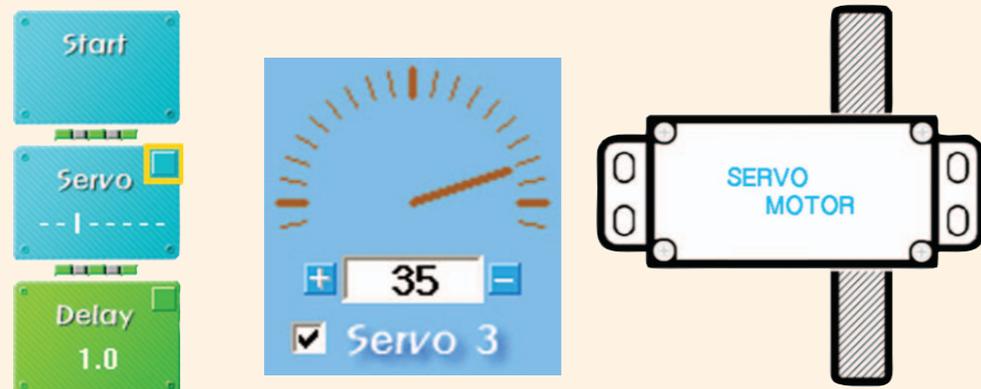
### Try This!

Set the Servo Motor Chip as a robot can turn left like the picture below.



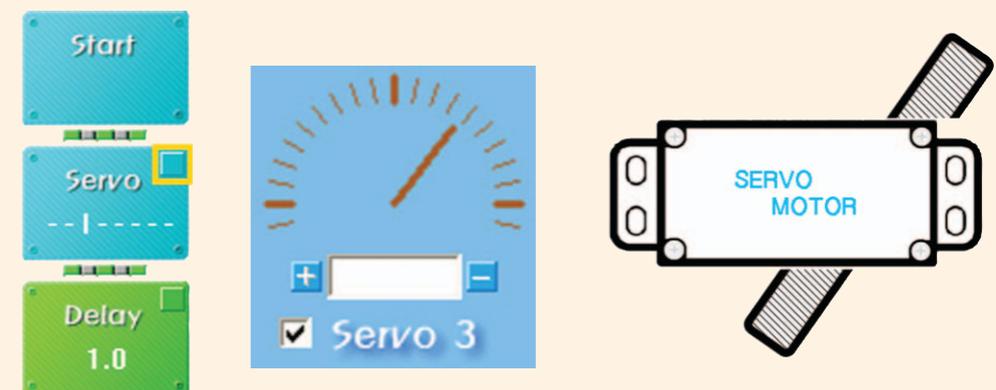
### Try This!

Set the starting point and then set the Servo Motor Chip as a robot can move forward like the picture below.



### Try This!

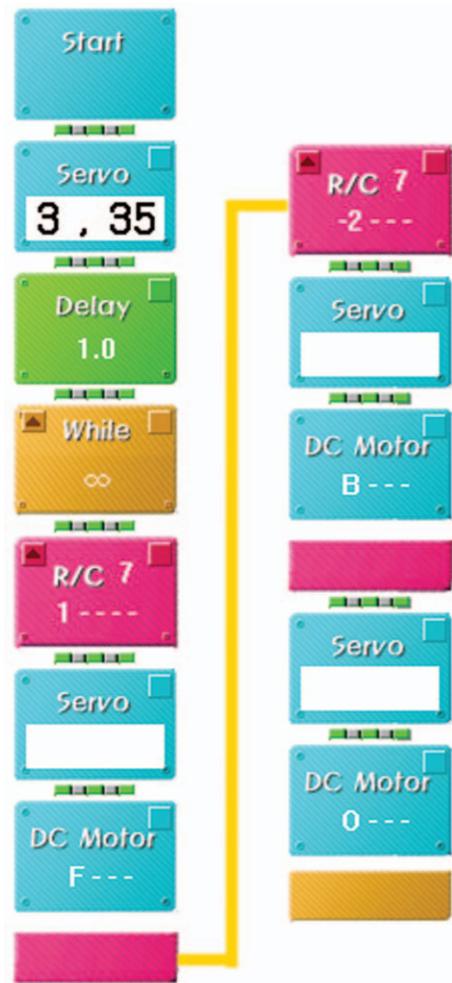
Set the Servo Motor Chip as a robot can turn right like the picture below.



# Shall we make it move?

# ScooterBot

**1** Make it move forwards when pressing 1 of the Wireless Remote Control and move backwards with 2.



**2** Make it turn left when pressing 1, 5 of the Wireless Remote Control and turn right with 1, 4.



**3** Make it turn left while moving backwards when pressing 2, 3 of the Wireless Remote Control and turn right while moving backwards with 2, 4.

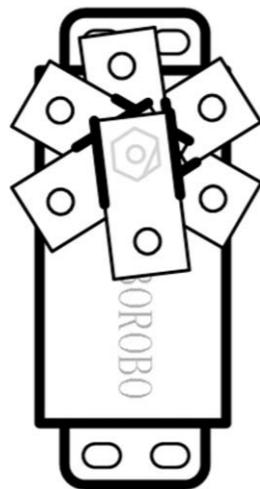


**4** Controlling Steering System by the Wireless Remote Control, have a race of going through paper cups without touching them and see who arrives the fastest.

# What did you learn?

# Work of the Day

1. To make a golfing robot using Servo Motor. Draw ○ on a direction that the Motor Guide should be inserted when the zero point is set.



**AvoidBot** is a robot that moves avoiding obstacles. Let's learn how to pass obstacles without touching them, using the three Sensor Boards and about the battery that transfers power to robot. Prepare several obstacles and compete who passes them the fastest!

- ▶ Avoid : keep away or change the direction from something
- ▶ Battery : an object that provides a supply of electricity for something such as a radio, car, or toy

Teacher's Evaluation and Task	Teacher's Confirmation

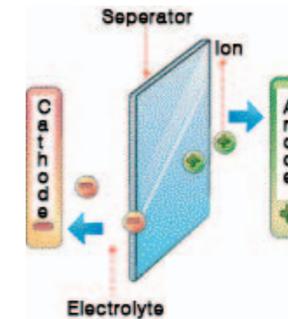
# What did you learn?

## • • • Battery • • •



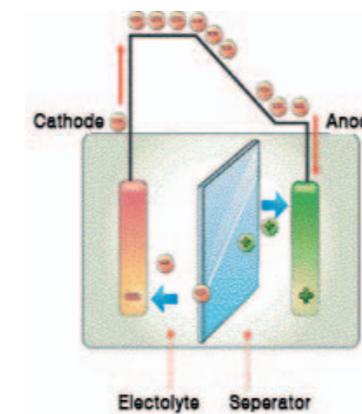
A Battery is used in many places in our daily life like a remote control of TV, a mobile fan, a camera, a clock and so on. When was the battery invented and started to use? It was not the exactly battery but almost same in structure and surprisingly had been used about 2000 years ago. It is called as Baghdad Battery which is presumptively used to plate accessories with gold · silver.

In 1780, Luigi Galvani found out the fact that the electricity flows When he connected a piece of metal to the hind leg of a frog and early products of current batteries started to get invented in 1800s. Currently there are so many kinds of batteries such as a manganese drycell, a mercury battery, a alkali-magnanese battery, a silver oxide cell, a Nickel-Metal Hydride battery, a lithium secondary cell, a lead storage battery, a solar battery and so on.



The Battery is structured with 4 basic components as the picture shown above.

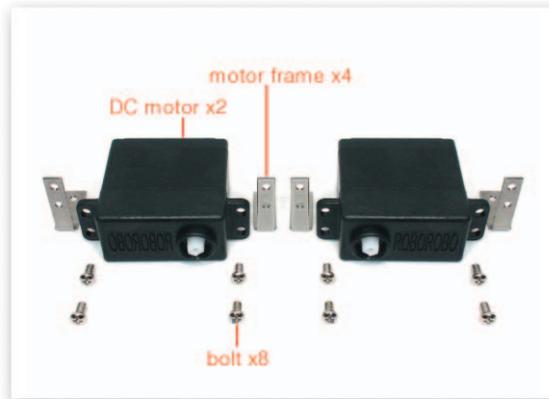
- Anode(+) : An electrode that receives electrons from the connected conducting wire and ions transferred to anode goes back to original substance
- Cathode(-) : An electrode that transfers electrons to connected conducting wire
- Electrolyte : A substance that travels between the anode electrode and the cathode due to chemical reactions
- Seperator : A screen to stop the direct contact between anode and cathode



Electron from cathode moves along conducting wire to turn on a the light or run an engine and then comes back to anode. Electricity flows from anode to cathode but electron flows from cathode to anode.

# How to Assemble

# AvoidBot



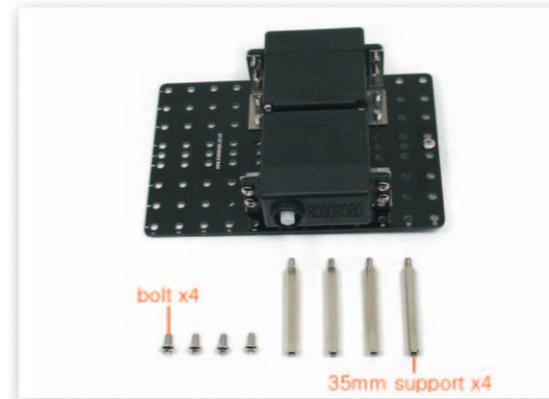
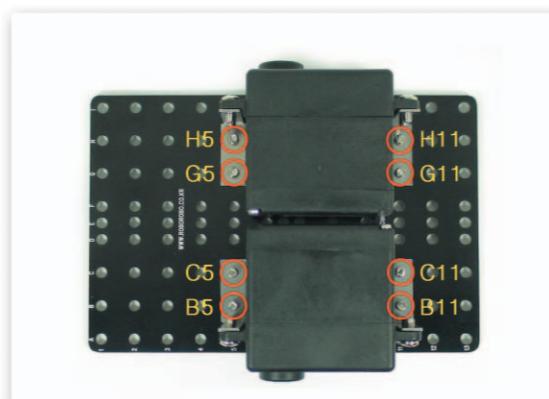
1 Fix the DC Motor and Motor Frame with bolts.



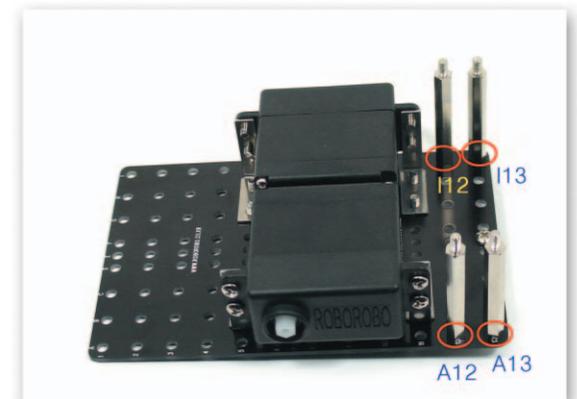
2 Put the Motor Frame that is fixed to the DC Motor to on the Main Frame and then fix with bolts.



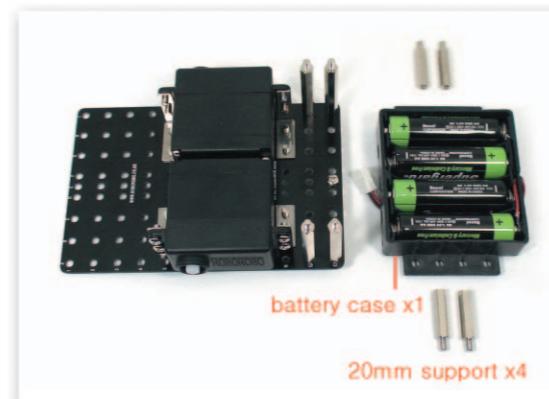
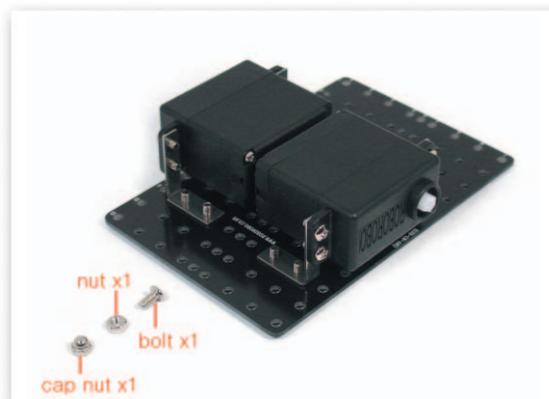
3 Insert a bolt to the Main Frame and then fix with a nut and a cap nut.



4 Fix the 35mm Support to the Main Frame with bolts.



5 Insert the Battery Case to the Support that is fixed to the Main Frame and fix with the 20mm Support.

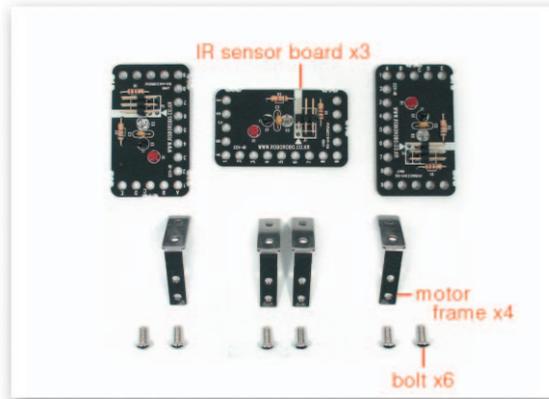


6 Fix the 40mm Support to the Main Frame with bolts.

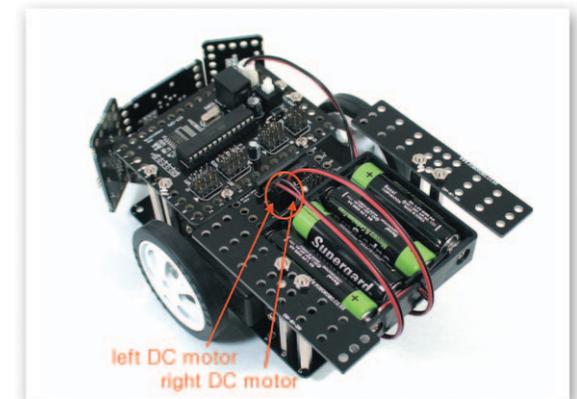
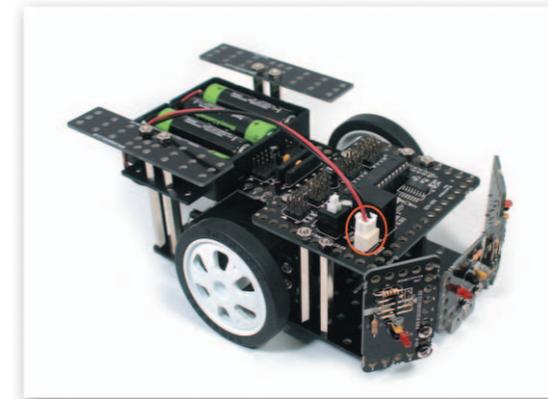


# How to Assemble

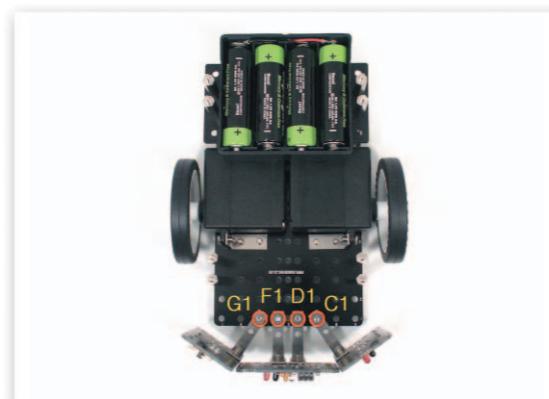
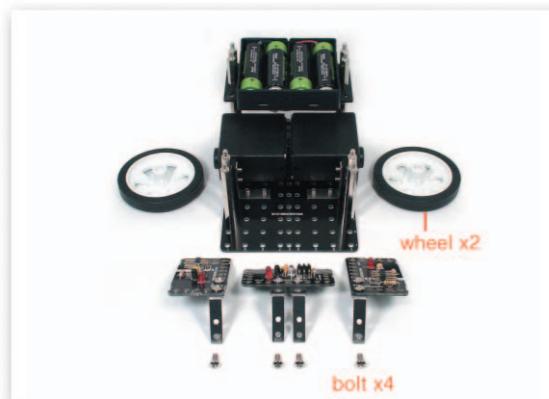
# AvoidBot



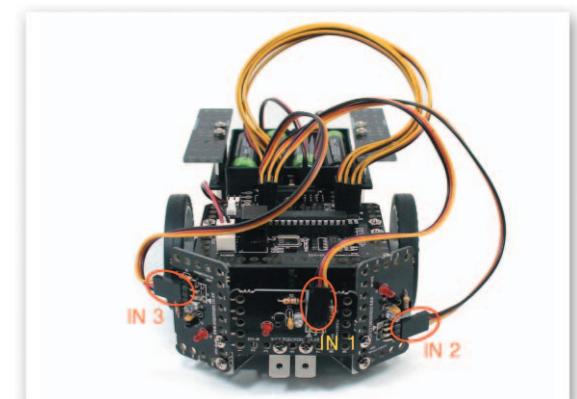
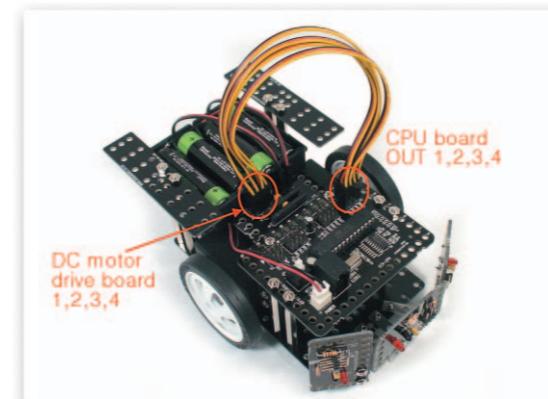
7 Fix the Infrared Sensor Board and the Motor Frame with bolts.



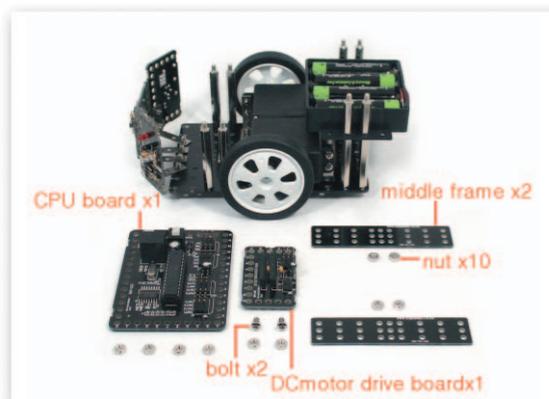
10 Connect the Power cable of the Battery Case to the Power Connector of CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A, B.



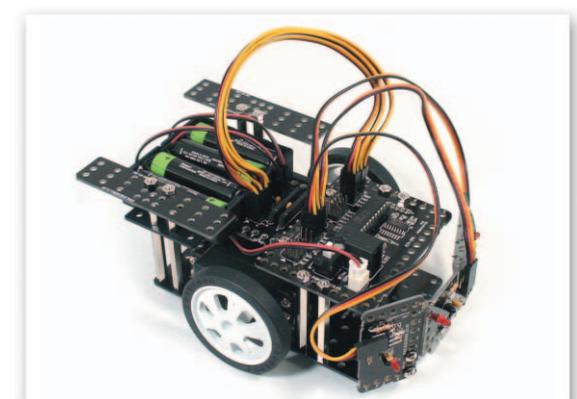
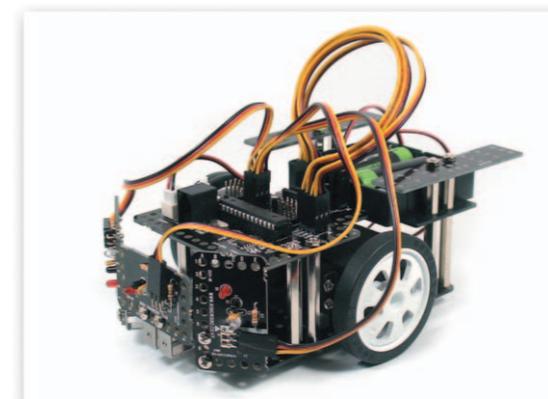
8 Fix the Motor Frame that is fixed to the Infrared Sensor Board to the Main Frame with bolts then insert wheels to DC Motor axle.



11 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and the DC Motor Drive Board 1, 2, 3, 4. Connect the 3 Pin Cable to IN Port 1, 2, 3 of the CPU Board and the Infrared Sensor Board.



9 Connect the CPU Board and the DC Motor Drive Board with bolts and nuts then insert it to the Support that is fixed to the Main Frame with nuts. Insert the Middle Frame to the Support that is fixed to the Battery Case and fix with nuts.



12 Completed AvoidBot.

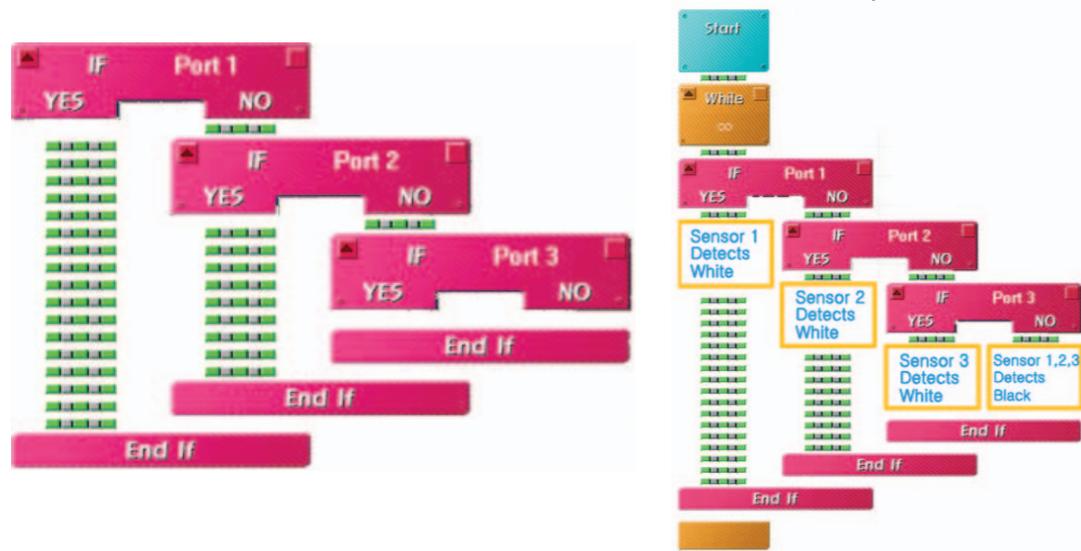
# Explain the Program

# AvoidBot

## Method of Avoiding Obstacles

- Main Function : Pass through obstacles by sensing its presence.
- Application : Make it turn left or right when the front sensor detects white, turn right when the left sensor detects white, turn left when the right sensor detects white and move forward when all sensors detect black.

[Example]



### Try This!

Make a robot to move backwards and then turn right to avoid when the left Infrared Sensor Board detects a hand with still using the front Infrared Sensor Board.



### Try This!

Make a robot to move backwards and then turn right to avoid when the right Infrared Sensor Board detects a hand with still using the front and left Infrared Sensor Board.



### Try This!

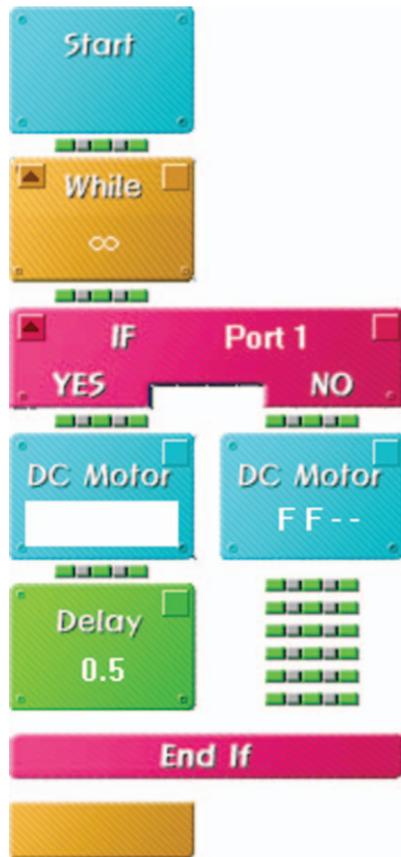
Make a robot that moves forward to stop when it detects a hand with the front Infrared Sensor Board



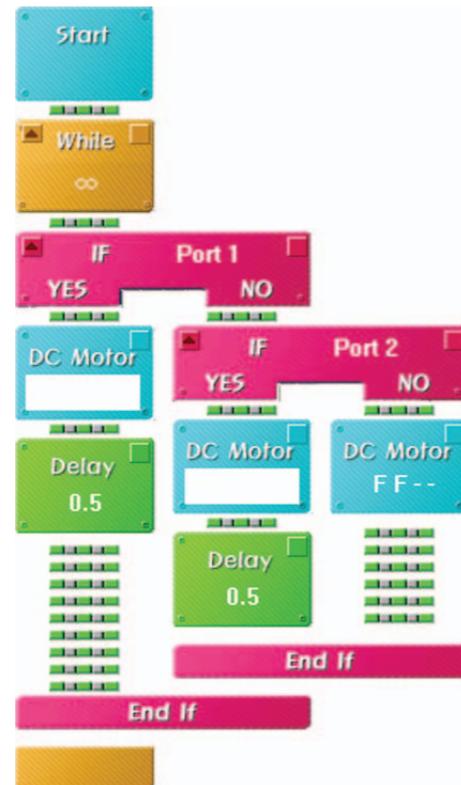
# Shall we make it move?

# AvoidBot

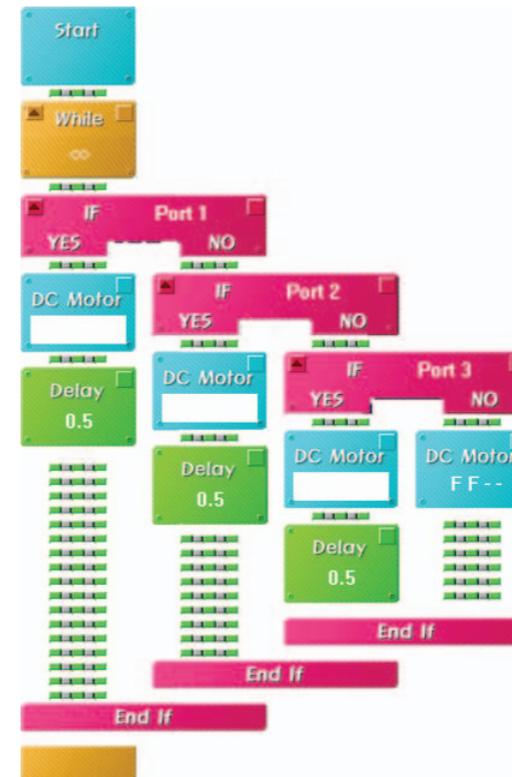
1 Make it avoid when the front Infrared Sensor Board detects the hand while moving forward.



2 Make it avoid when the left Infrared Sensor Board detects the hand while moving as 1.



3 Make it avoid when the right Infrared Sensor Board detects the hand while moving as 1, 2.

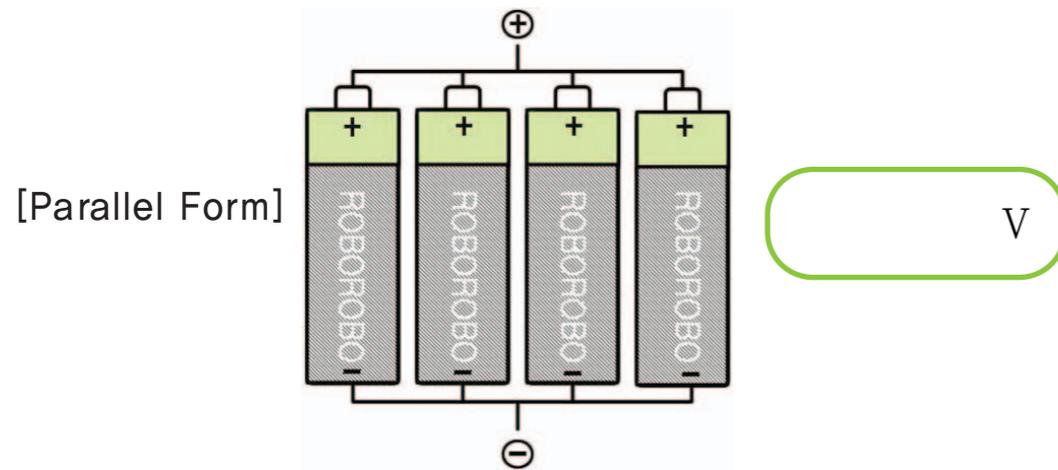
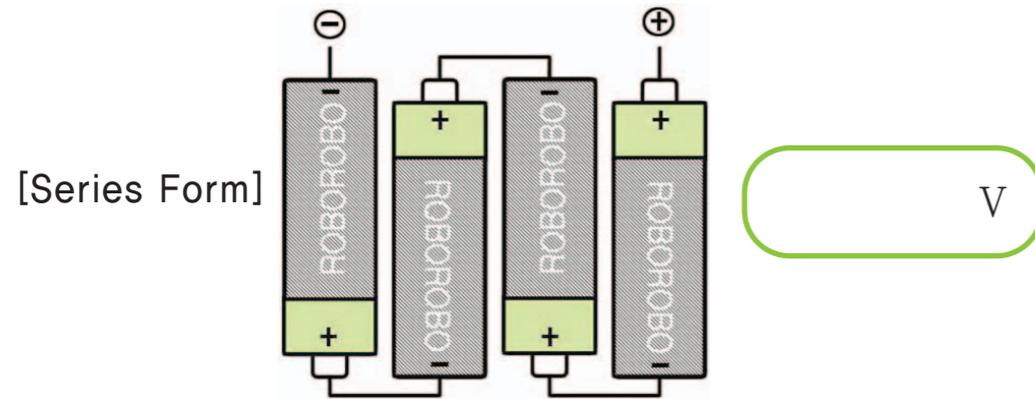


4 Put several paper cups and make a robot pass through without touching them using the Infrared Sensor Board.

# What did you learn?

# Work of the Day

1. Write a voltage of 1.5V Batteries when they are connected in series and the parallel form as below.



Teacher's Evaluation and Task	Teacher's Confirmation



**FortressBot** is a throwing robot. Learn the origin and the principle of a ballista that is used in ancient times and pile up the paper cups and compete who breaks the most cup tower with FortressBot that moves freely with the Wireless Remote Control!

- ▶ Fortress gun : Fixed defensive canon at fortress
- ▶ Ballista : a device for shooting small stones in ancient times

• • • Ballista • • •



<A ballista using Elasticity>

A ballista is a weapon that is used in ancient Greece and Rome and made for siege warfare (a battle to siege or attack and steal a fortress). It was a weapon that was used to support soldiers who climb up the fortress wall when attackers want to break a gate or fortress wall or open the enemy's gate. It was invented by the mathematician Archimedes.

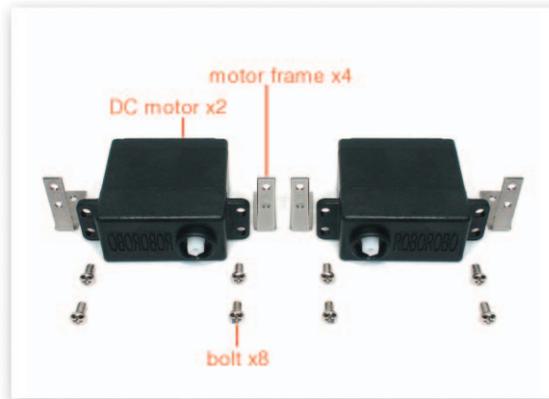
The principle of ballista is as same mechanical principle as catapult (a bow that shoots several arrows at once). Power of ballista and catapult is the force of restitution of the rope that is tied and twisted to both poles. It is same principle as a pen spins because of the force of restitution of a rubber-band when winding up a pen after tying a pen between a rubber-band. A stick tied up in ropes turns back and pull bowstring so stone or others on bowstring flies. Ropes that used in ballista required elasticity like rubber-bands. Rubber-band only has history of 100 years so people used with elastic materials such as horsehair, tendon of animal and human hair.

The biggest ballista with strongest in power and size among ballista is trebuchet which appeared in 3rd century. This ballista used theory of lever which is putting weight under ballista and when the weight has pulled up and down and as top of barrel of cannon get pulled up, shoots cannon balls. Usually weight was a triangular box with stone like things. As weight gets heavier, power of ballista grows. A drop of this weight made a hole of 2-3m deep. This huge ballista had stronger power with heavier weight however also had disadvantages such as difficulty in pulling up and taking much time to shoot due to heavy weight.

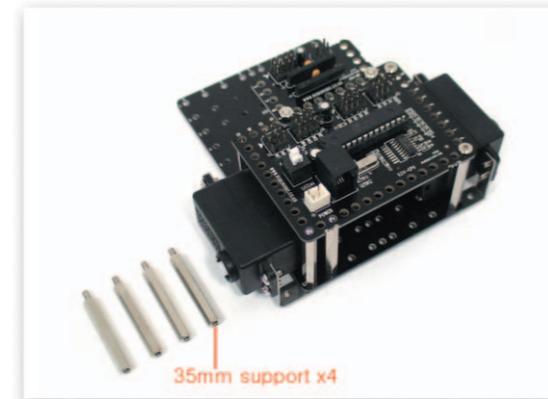
Is your FortressBot used elasticity of rubber-band? Or used theory of lever?

# How to Assemble

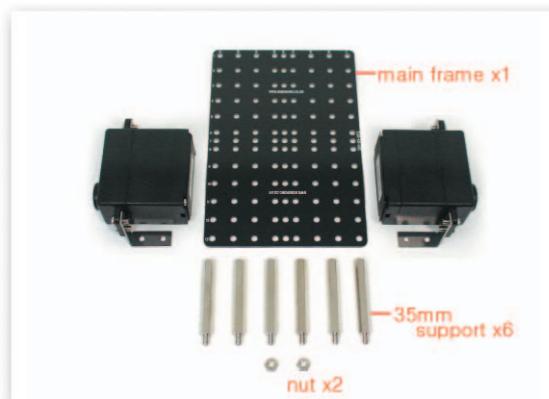
# FortressBot



1 Fix the DC Motor and Motor Frame with bolts.



4 Connect the 35mm Support to the Support that holds the CPU Board.



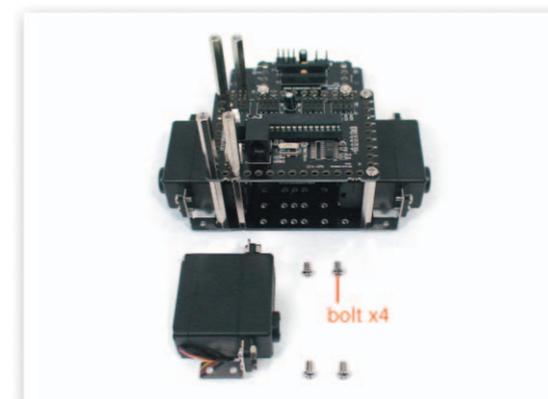
2 Put the Motor Frame that is fixed to the DC Motor under the Main Frame and fix with the 35mm Support. (Fix the 35mm Support with nuts on H1, H6)



5 Fix the Servo Motor and the L-type 2x2 Frame with bolts and nuts.



3 Fix the CPU Board and the DC Motor Drive Board with bolts and nuts then put them on the Support and fix with bolts.

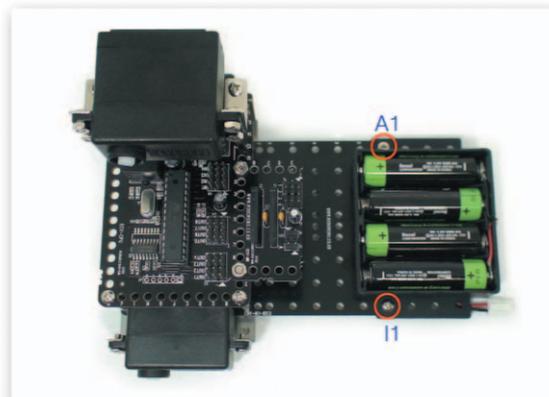
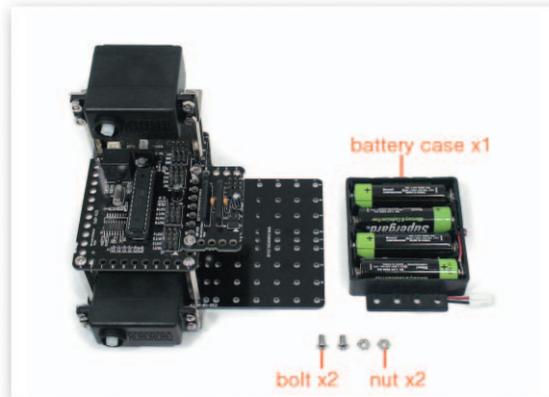


6 Put the L-type 2x2 Frame that is fixed Servo Motor on the Support and fix with bolts.



# How to Assemble

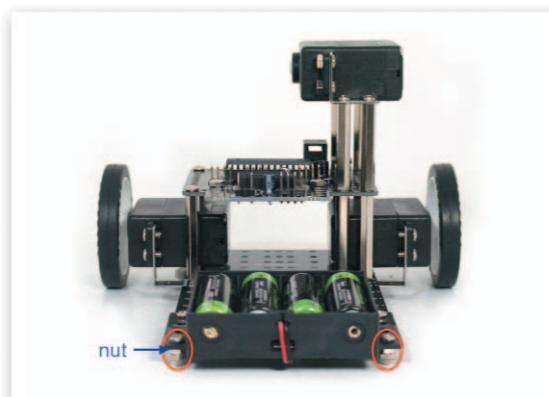
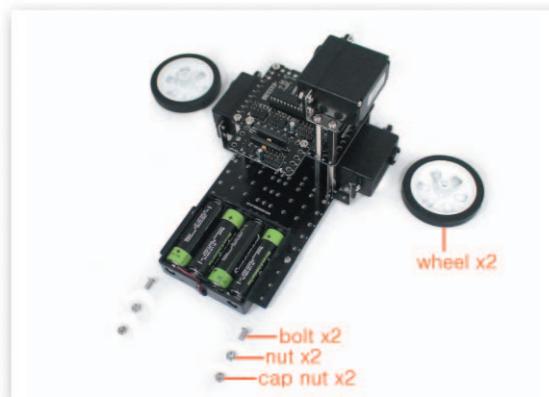
# FortressBot



7 Put the Battery Case on the Main Frame and fix with bolts and nuts.



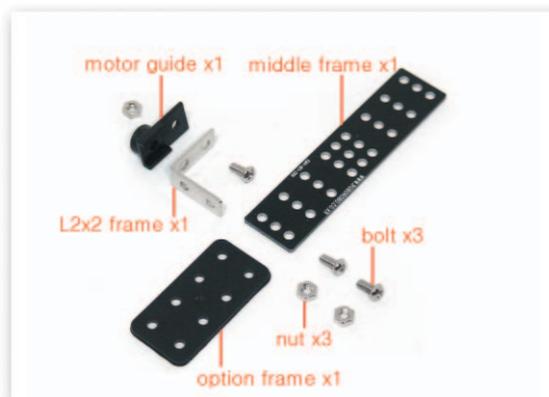
10 Insert the 7mm Support to the Wheel Guide then fix with bolts.



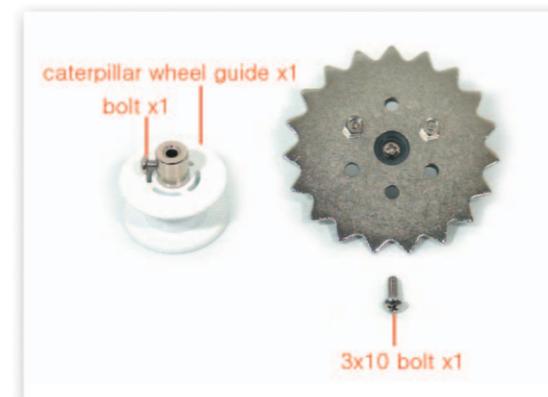
8 Insert bolts to the Battery Case and fix with nuts and cap nuts then insert wheels to the DC Motor axle.



11 Put the Wheel Guide on the Caterpillar Wheel and fix with bolts and nuts.



9 Fix the Motor Guide to the L-type 2x2 Frame with bolts and nuts. Overlap the Option Frame, the Middle Frame and the L-type 2x2 Frame and fix with bolts and nuts.



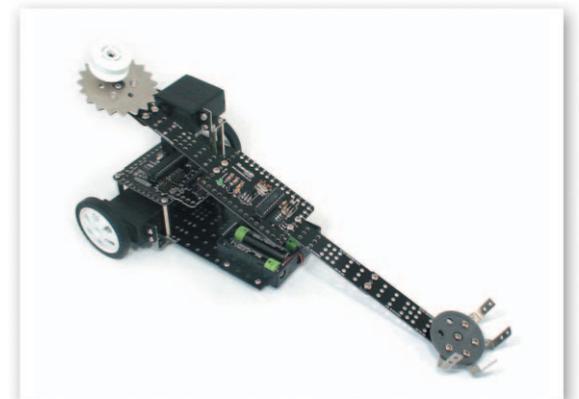
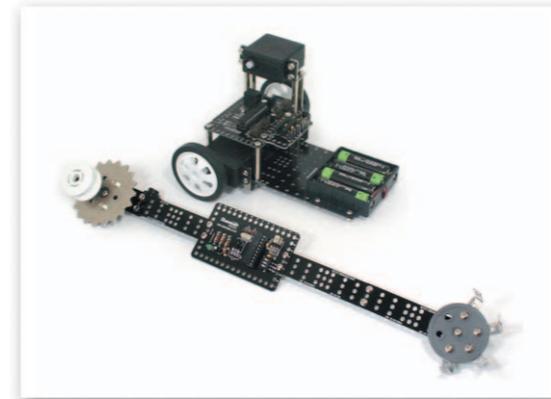
12 Fix the 3x10 bolt to the Caterpillar Wheel then insert the Caterpillar Wheel Guide to the 3x10 bolt and fix with a bolt.

# How to Assemble

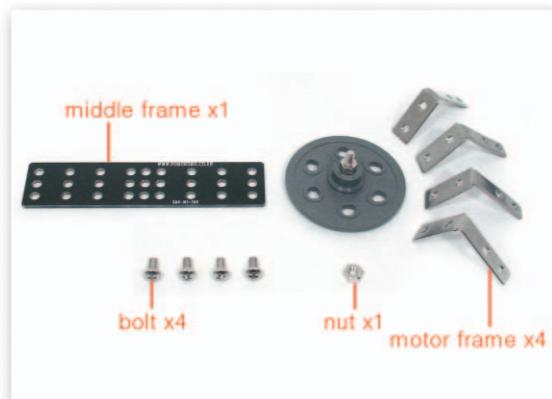
# FortressBot



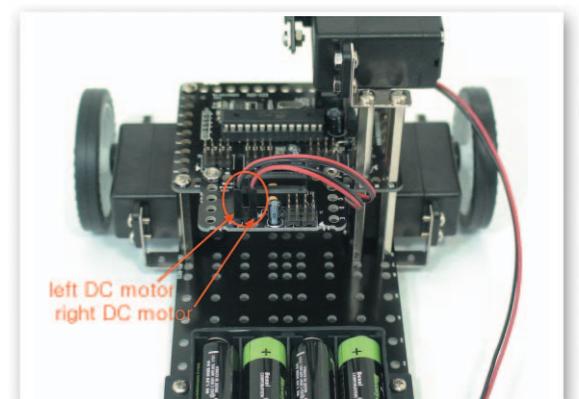
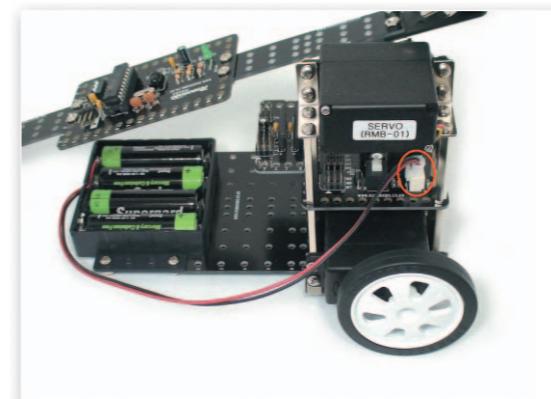
13 Fix the Support that is fixed to the Wheel Guide to the Option Frame with a nut.



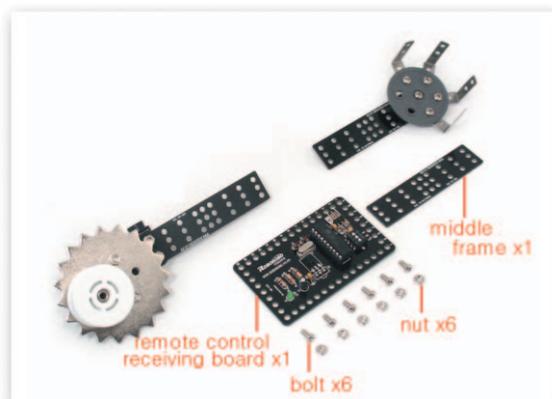
16 Insert the Motor Guide that is fixed to the Option Frame to the DC Motor axle.



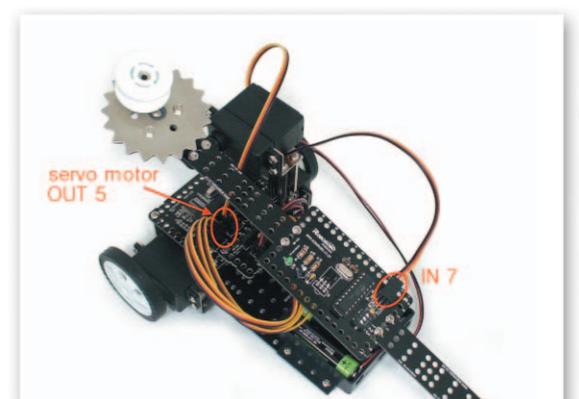
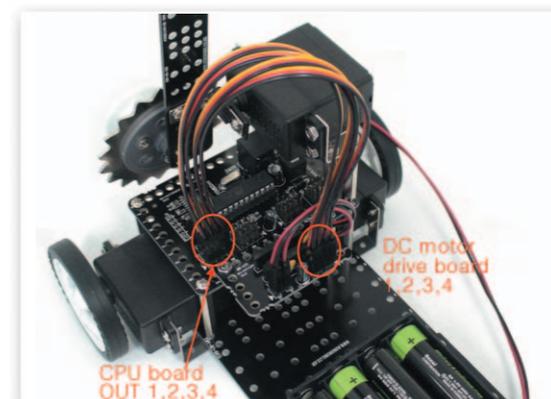
14 Fix the Motor Frame to the Wheel Guide with bolts then fix the Wheel Guide and the Middle Frame with a nut.



17 Connect the Power cable or the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A, B.



15 Connect the Remote Control Receiving Board and the Middle Frame with bolts and nuts. And fix the Middle Frame which the Caterpillar Wheel is connected and the Middle Frame which the Wheel Guide is connected.



18 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and 1, 2, 3, 4 of the DC Motor Drive Board, Connect the Servo Motor cable to OUT Port 5. Connect the 3 Pin Cable to IN Port 7 of the CPU Board and the Remote Control Receiving Board.

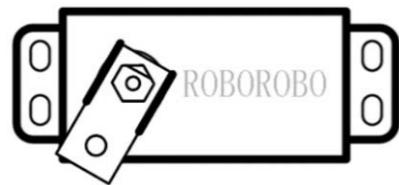
# Explain the Program

# FortressBot

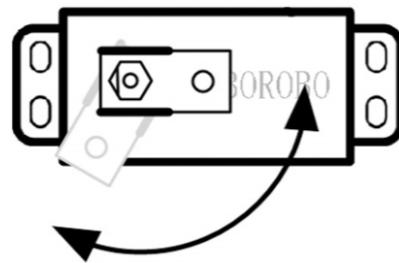
## Set the Servo Motor

- Main Function : Setting the starting point and the rotation position.
- Application : Set the zero point and then insert the Motor Guide on a position of setting up the starting point and set the rotating position with the Servo Motor Chip.

[Position of Setting the Starting Point]

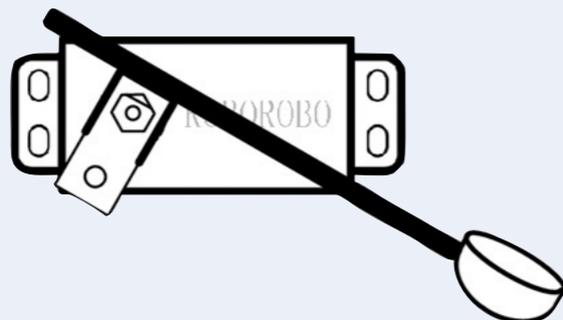


[Radius of Rotation]



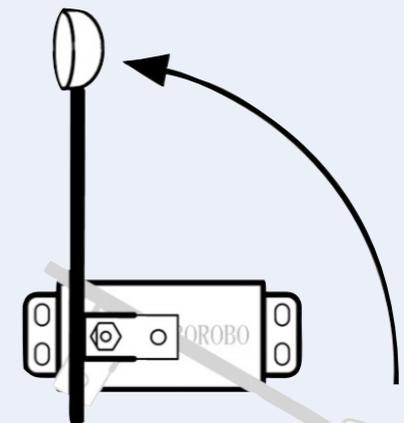
### Try This!!

Set the starting point of the Servo Motor Chip to put things on a robot.



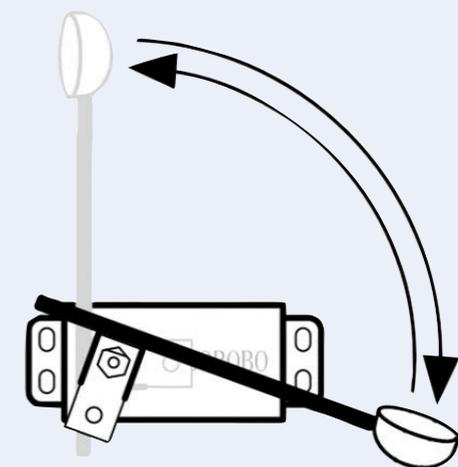
### Try This!!

Set the Servo Motor Chip as the robot can throw things.



### Try This!!

Set the Servo Motor Chip as puts things on a robot then throws things and comes back to its original position.



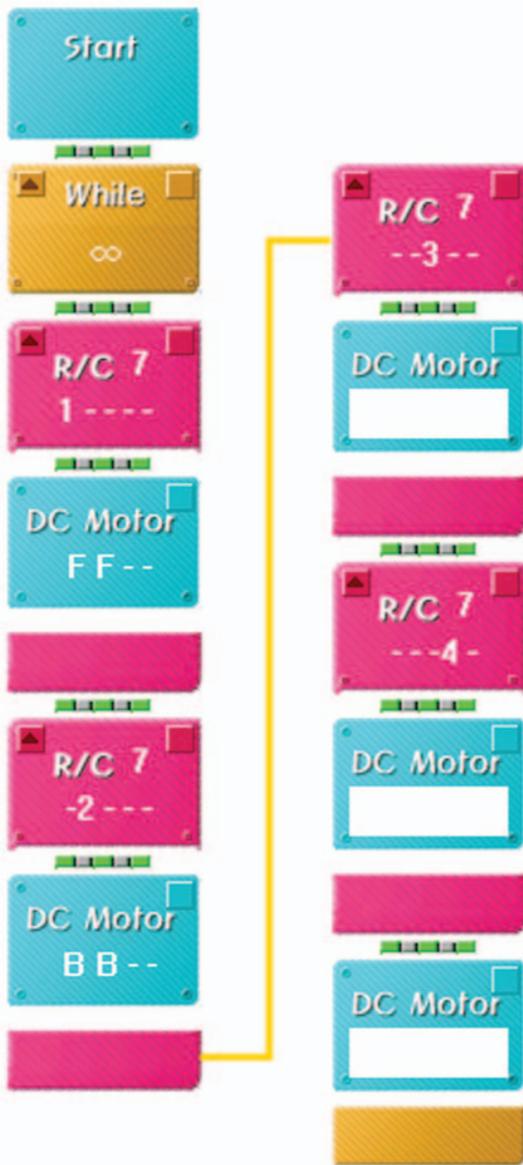
# Shall we make it move?

# FortressBot

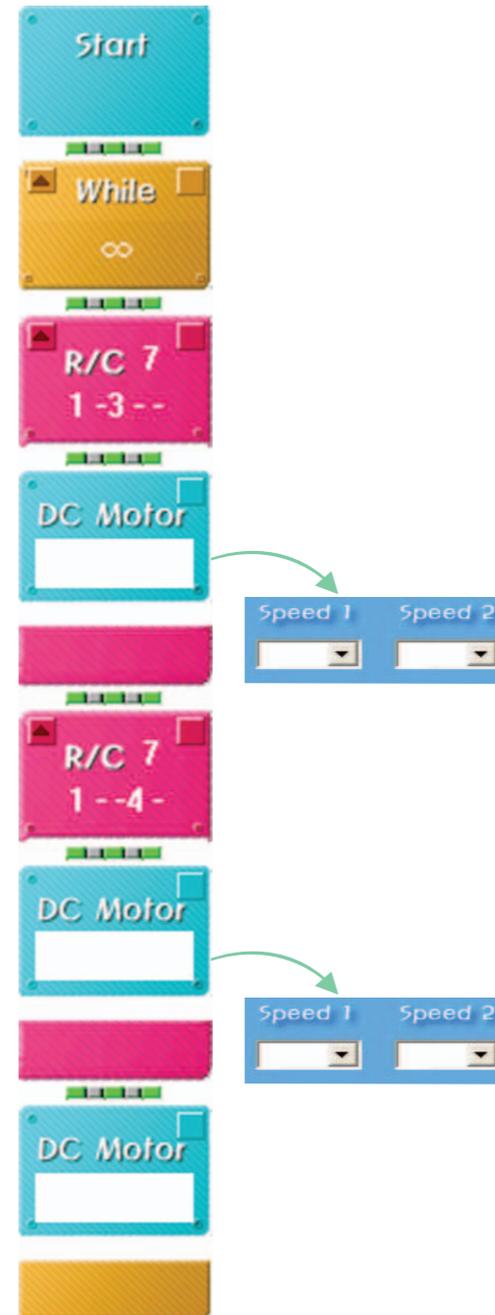
1 Make it throw things when pressing the Wireless Remote Control 5.



2 Make it move forwards when pressing the Wireless Remote Control 1, move backwards with 2, turn left with 3 and turn right with 4.



3 Make it turn left while moving forward when pressing the Wireless Remote Control 1, 3 and turn right while moving forward with 1, 4.



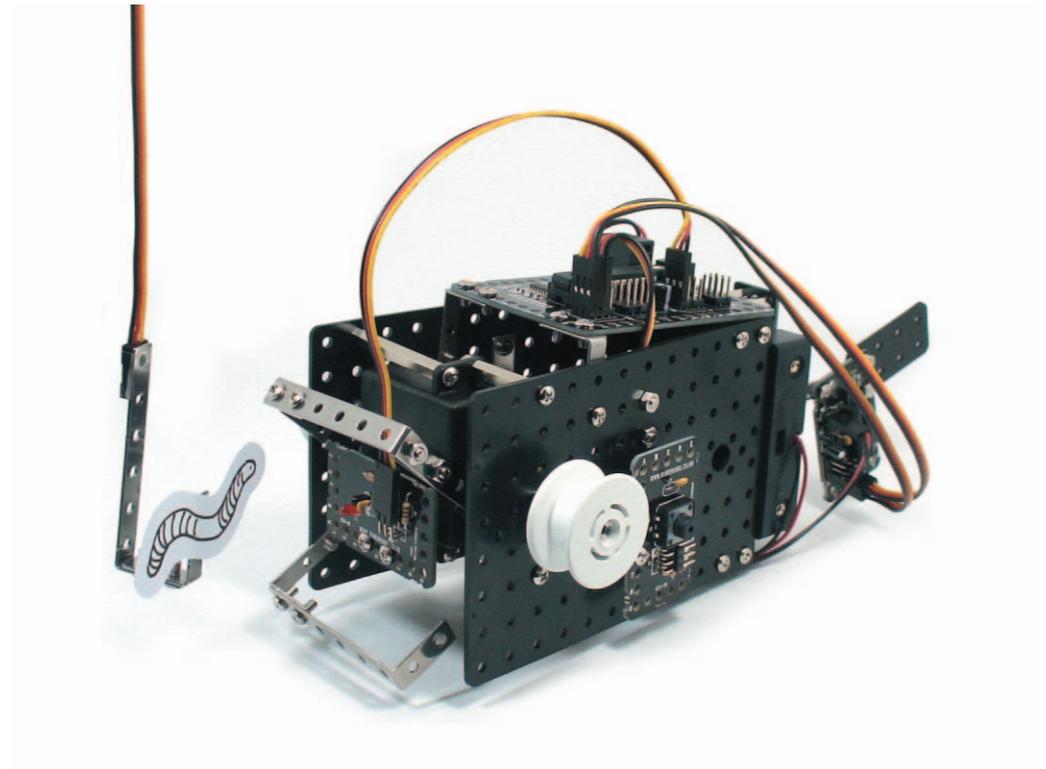
4 Compete who breaks many paper cup towers.

# What did you learn?

# Work of the Day

1. Match the DC Motor and the Servo Motor with relevant explains and Draw a line that comes under DC Motor to "DC Motor" and Servo Motor

- Can control the speed.
- Easy to control position.
- Fast battery consumption.
- Can rotate 360°.
- Used in printer, DVD, camcorder, CCTV, camera and others.



**FishingBot** is a robot looks like a fish. If Infrared Sensor Board detects bait, the Servo Motor closes its mouth and swallow the bait. Let's learn about the reason to develop the fish robot and usage of it and play a game after making FishingBot.

.....  
 ▶ Fishing : the sport, hobby, or business of catching fish

Teacher's Evaluation and Task	Teacher's Confirmation

• • • Fish Robot • • •



(Fish Robot in London Aquarium)

You may have ever heard about the variety of robots like a cleaning robot that cleans house, a humanoid that looks like human, dog robot that entertains humans from TV or newspapers or others. And even a fish robot that swims in water.

Fish Robot is actively studied in the United States of America, Japan, France and in Korea. Why are they making a fish robot which is not a submarine or a ship? That is because future submarine will gradually change to fish robot. Fish that has evolved for a long period of time has suitable structure for underwater life like thrust or driving force. You can easily see shark or seal or dolphin chasing prey with instant fast speed on TV. Machines that human had made currently does not move as freely as them. However fish robot that imitates motions of fish could move as real fish with more studies.

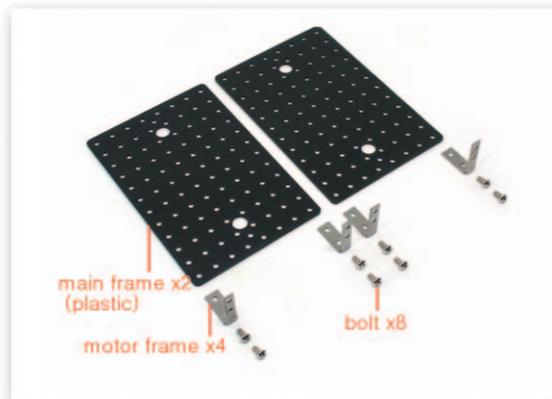


Also there is a military reason to make fish robot. A underwater mine is partially buried in shallow sea floor and is made to explode automatically when ship contacts it. To find this underwater mine, diver himself or trained dolphin searches for it however it is very dangerous and not prompt method. But we expect fish robot or lobster robot to solve this problem. Lobster robot is very effective to explore sea floor and also there is a flat bodied fish robot like a flatfish. These shaped robots are suitable for detection which can move smoothly and does not catch from a fish net plus, can stay underwater for long period of time.

Like other than fish robot, lobster robot, turtle robot, jellyfish robot and others are on study. Will the day come to meet a fish living in dark, high water-pressured abyss by riding an underwater robot that is being developed diversely?

# How to Assemble

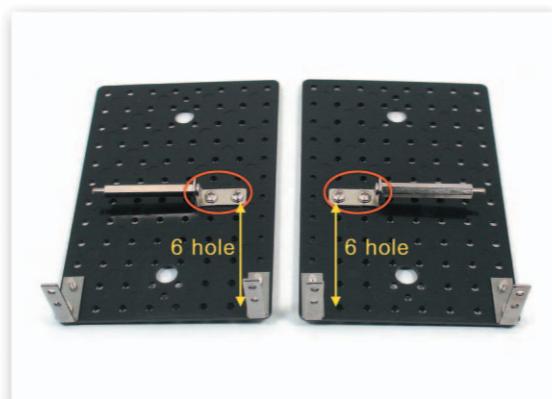
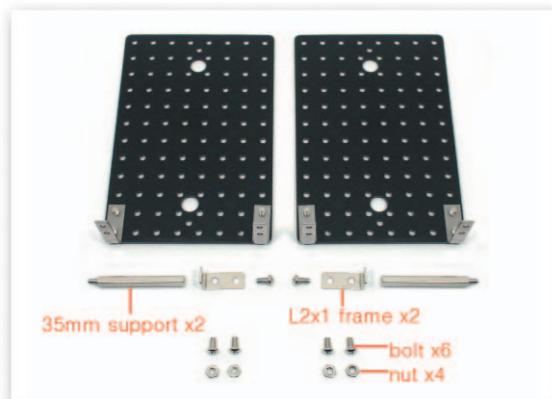
# FishingBot



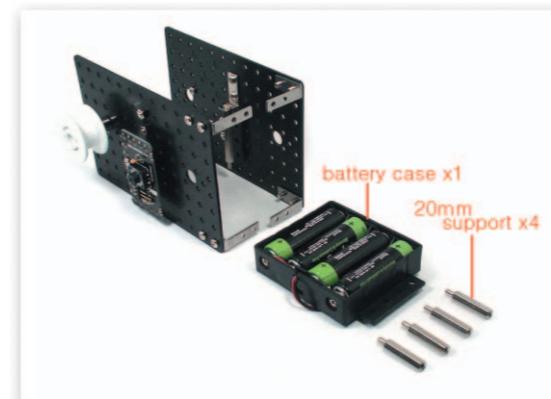
1 Fix the Motor Frames to the Main Frames with bolts.



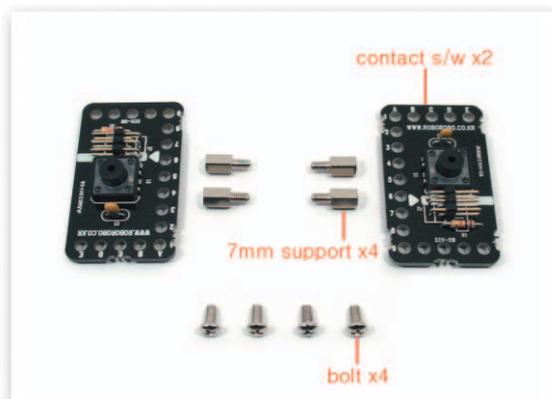
4 Fix the 7mm Supports that is fixed to the Contact Sensor Boards to the Main Frames. Fix the 3x10 bolts to the Main Frames then insert the Caterpillar Wheel Guides to 3x10 bolts and fix with bolts.



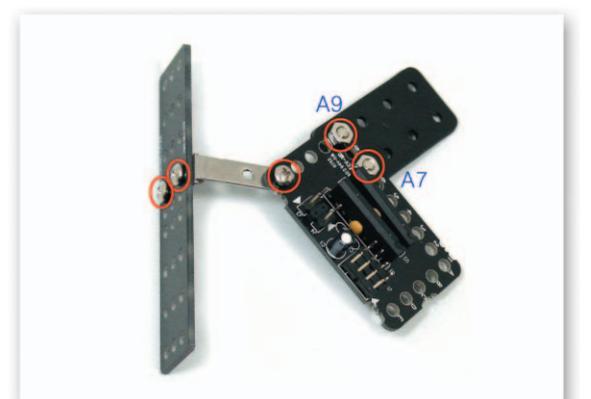
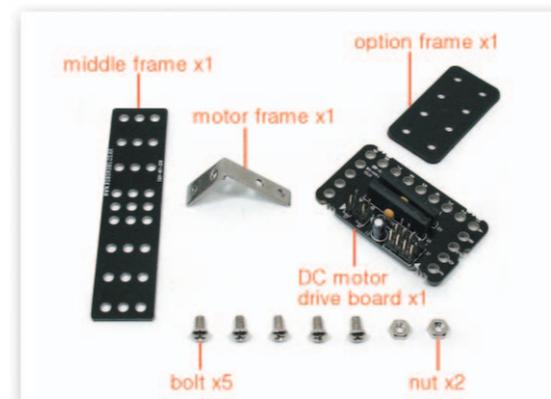
2 Fix the 35mm Supports to the L-type 2x1 Frames with bolts and then fix the L-type 2x1 Frames to the Main Frames with bolts and nuts.



5 Put the Battery Case on the Motor Frames and fix with the 20mm Supports.



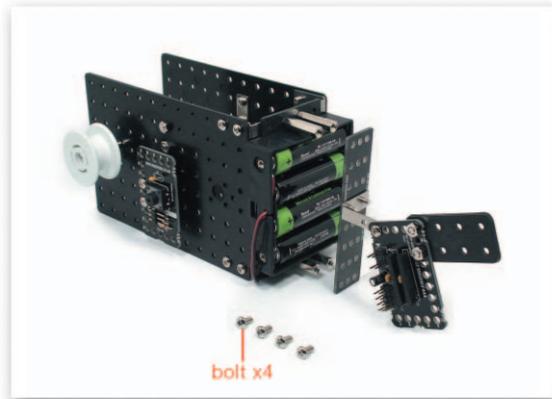
3 Fix the 7mm Supports to the Contact Sensor Boards using bolts.



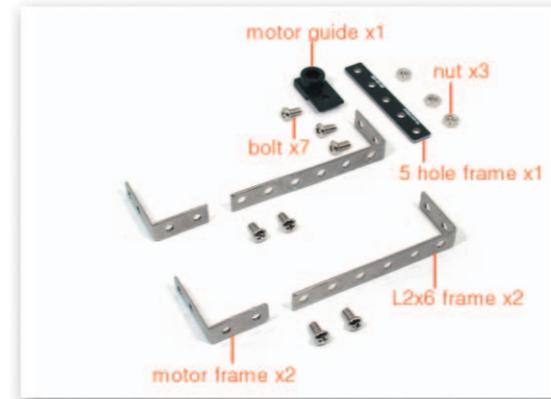
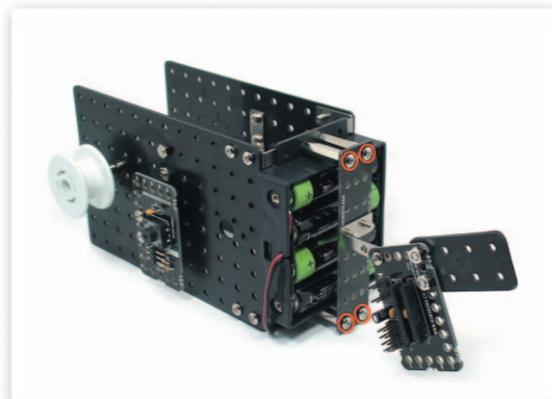
6 Fix the Option Frame to the DC Motor Drive Board with bolts and nuts. Then connect the Middle Frame and the DC Motor Drive Board with the Motor Frames using bolts.

# How to Assemble

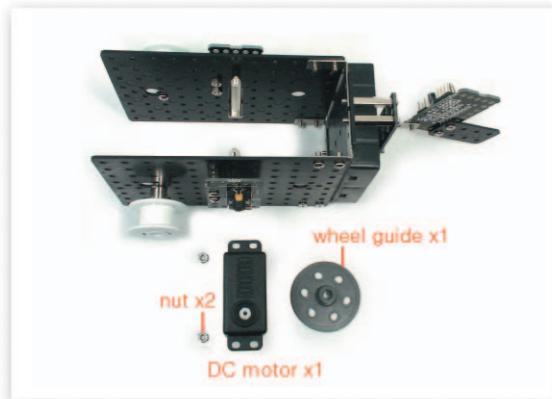
# FishingBot



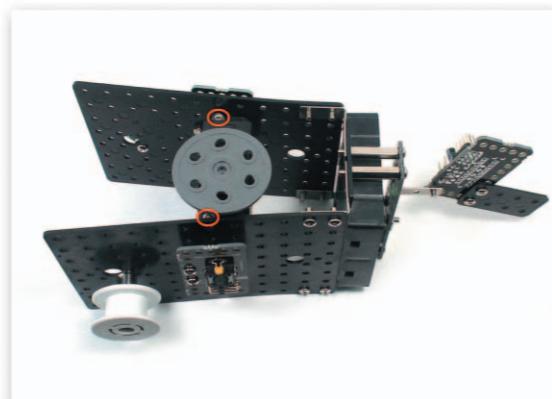
7 Put Middle Frame that is connected to the DC Motor Drive Board on the Support and fix with bolts.



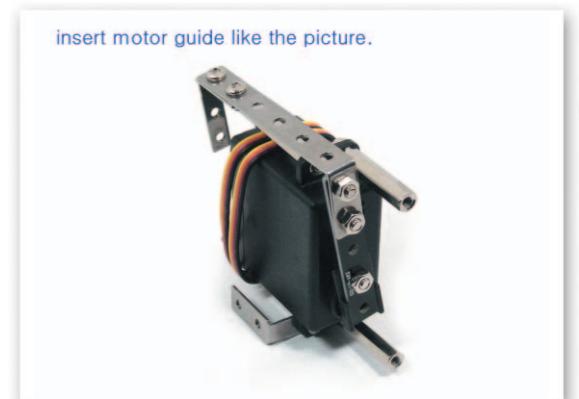
10 Connect the Motor Frames and the L-type 2x6 Frames with bolts. Then overlap the Small 5 Frame and the Motor Guide on the L-type 2x6 Frame and fix with bolts and nuts.



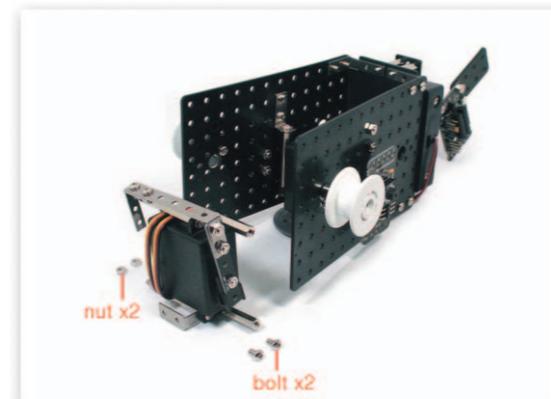
8 Fix the DC Motor to the 35mm Support with nuts and then insert the Wheel Guide to the DC Motor axle.



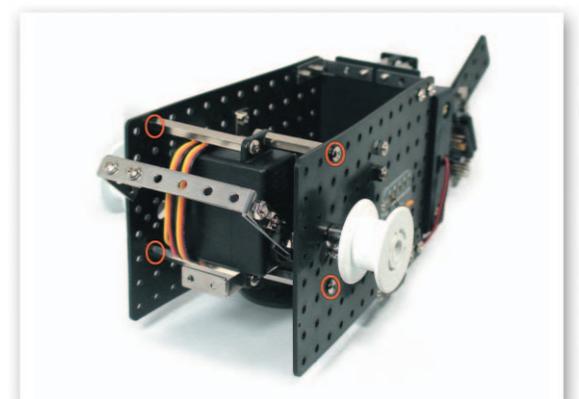
11 Insert the Motor Guide that is connected to the L-type 2x6 Frame to the Servo Motor axle.



9 Overlap the 25mm Supports and the 40mm Supports to the Servo Motor on the Motor Frame and fix with bolts and a nut.

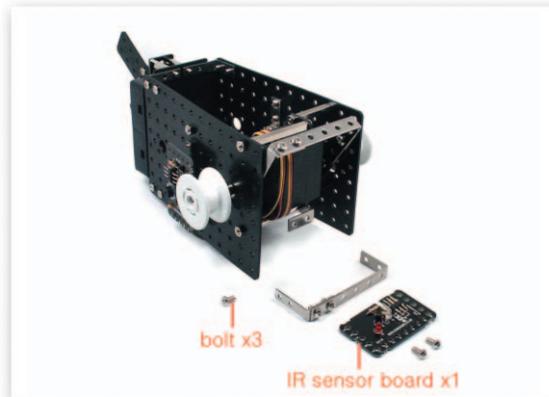


12 Put the Servo Motor inside the Main Frame and fix with bolts and nuts.

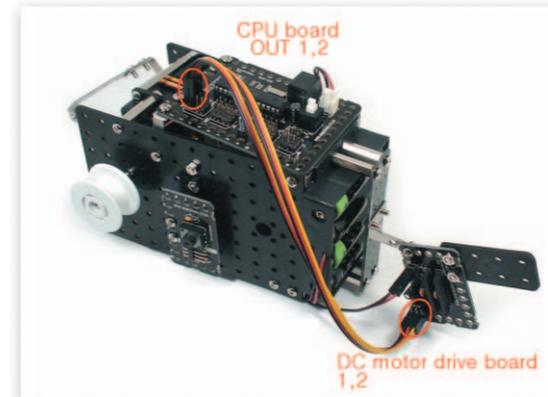


# How to Assemble

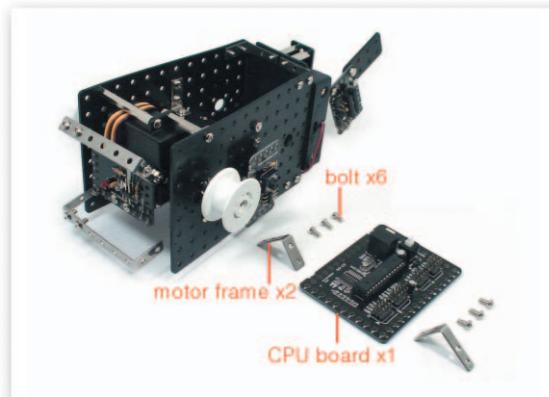
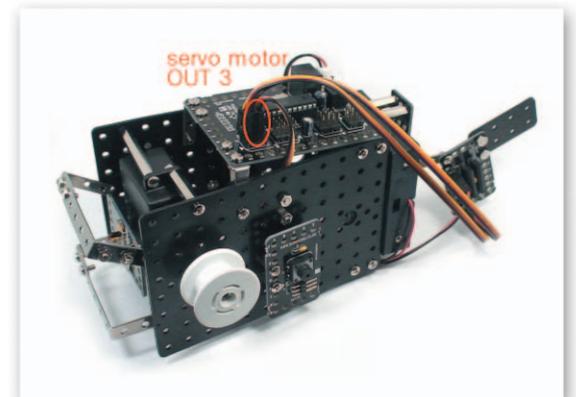
# FishingBot



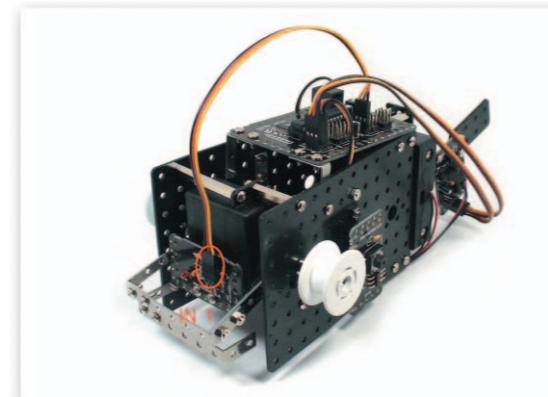
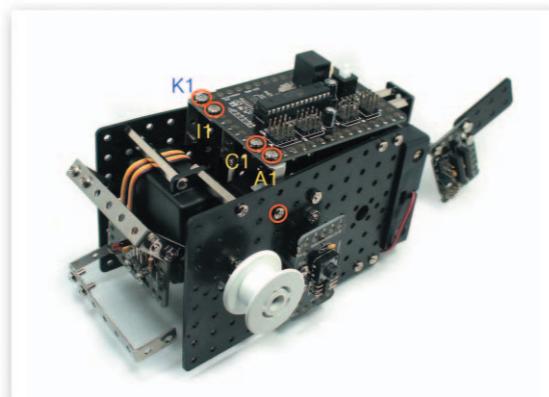
13 Fix the Infrared Sensor Board to the Motor Frame that is fixed to the Servo Motor with bolts. Then fix the Motor Frame that is connected with the L-type 2x6 Frames to the Main Frames with bolts.



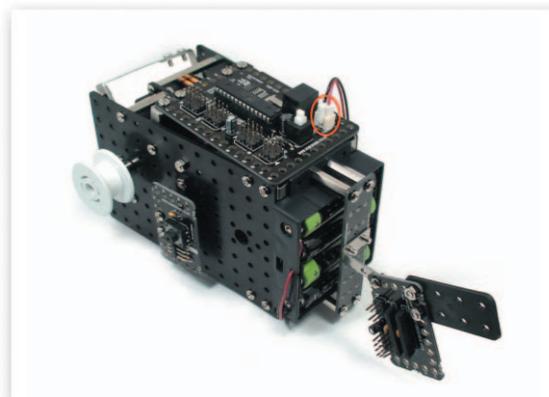
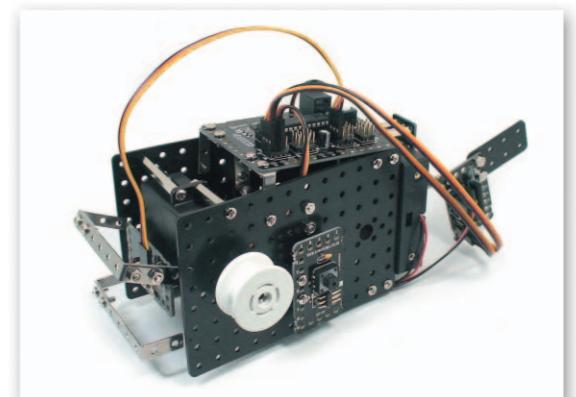
16 Connect the 3 Pin Cable to OUT Port 1, 2 of the CPU Board and the DC Motor Drive Board 1, 2. Connect the Servo Motor cable to OUT Port 3 of the CPU Board.



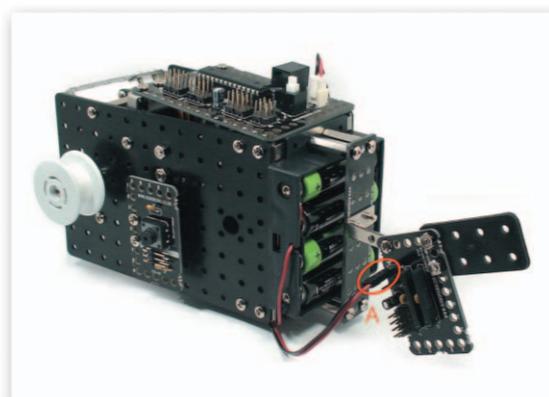
14 Connect the CPU Board to the Motor Frames and then fix to the Main Frames with bolts.



17 Connect the 3 Pin Cable to IN Port 1 of the CPU Board and the Infrared Sensor Board. Completed FishingBot.



15 Connect the Power cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A.



18 Fix the Motor Frame and the L-type 2x6 Frame with bolts then connect the 3 Pin Cable to the Small 8 Frame using tapes. Draw the bait on the white background and stick it to the fishing needle to complete the fishing rod.



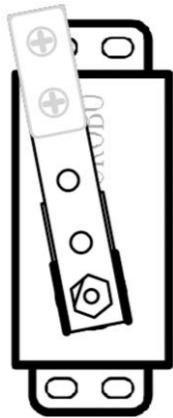
# Explain the Program

# FishingBot

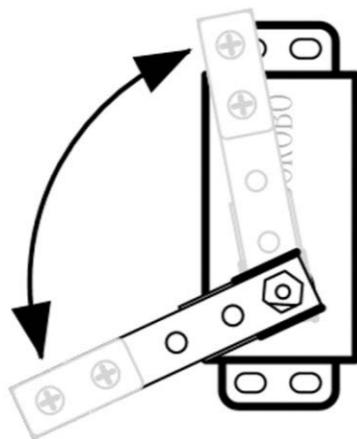
## Set the Servo Motor

- Main Function : Setting up starting point and rotation position.
- Application : Set the zero point and then insert the Motor Guide on a position of setting the starting point and set the rotating position with the Servo Motor Chip.

[Position of Setting Up Starting Point]

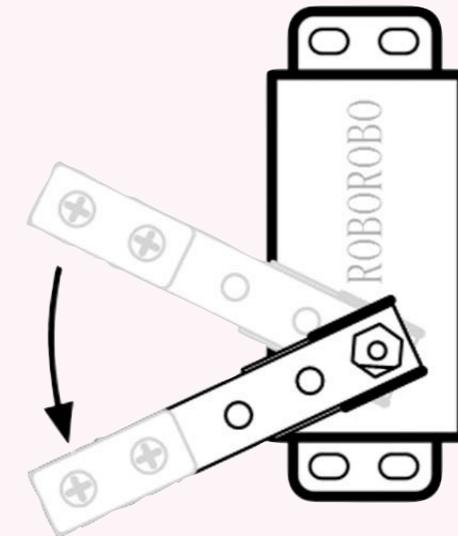


[Radius of Rotation]



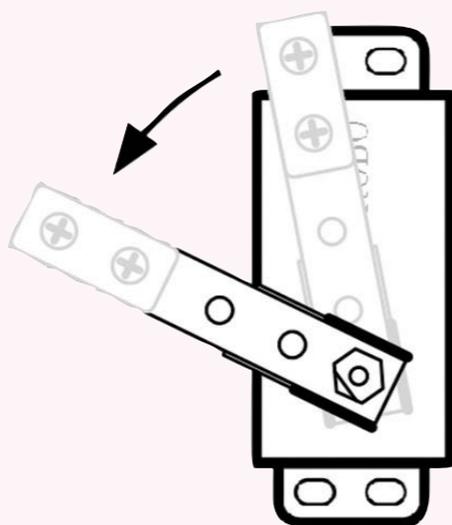
### Try This!!

Set the Servo Motor to make the robot close its mouth.



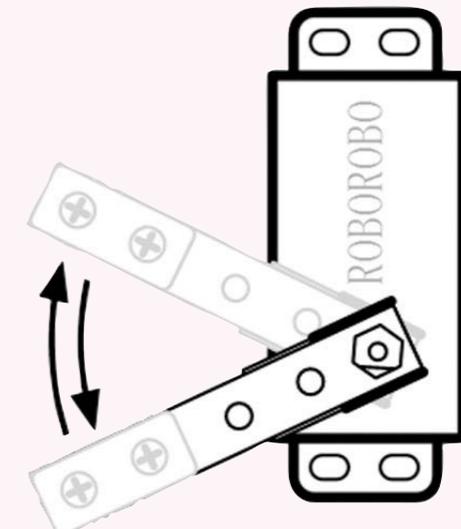
### Try This!!

Set the starting point of the Servo Motor to make robot to open its mouth.



### Try This!!

Set the Servo Motor to make the robot to close its mouth and open and then close again.



# Shall we make it move?

# FishingBot

1 Make it close its mouth when the front Infrared Sensor Board of the stopped robot detects object.



2 Make the robot to move wiggling continuously.



3 Make it stop and close its mouth when the front Infrared Sensor Board of the wiggling robot detects object.

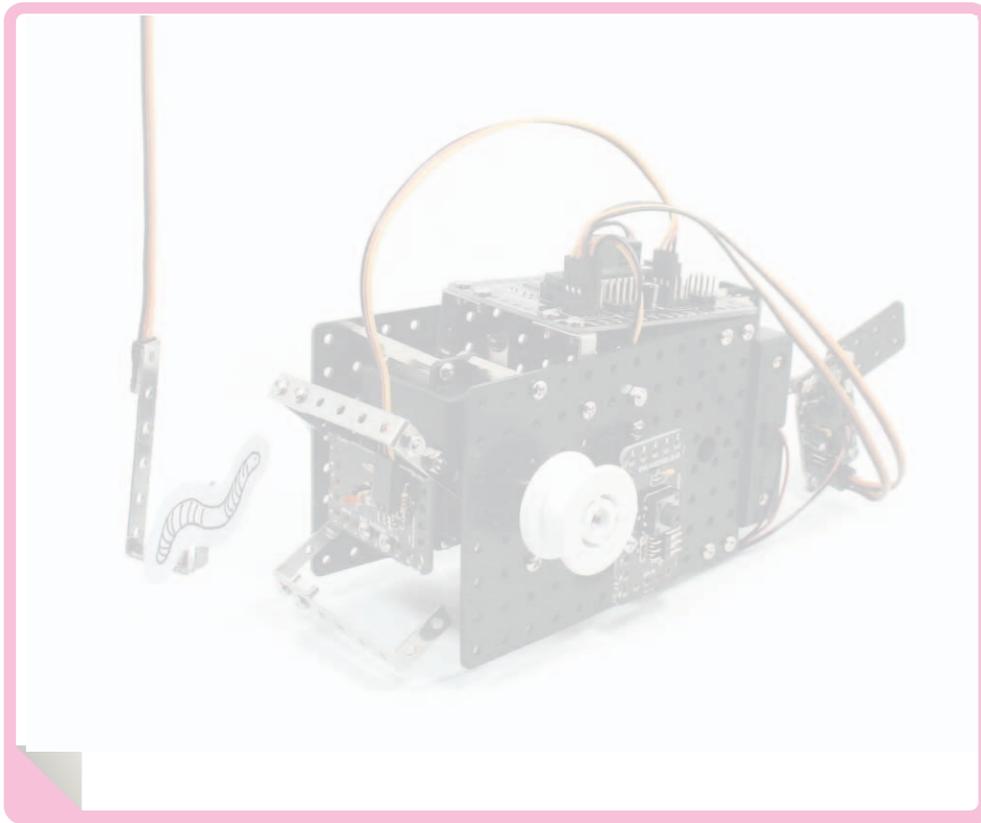


4 Play fishing game to make it bite fishing needle when it detects bait using front Infrared Sensor Board.

# What did you learn?

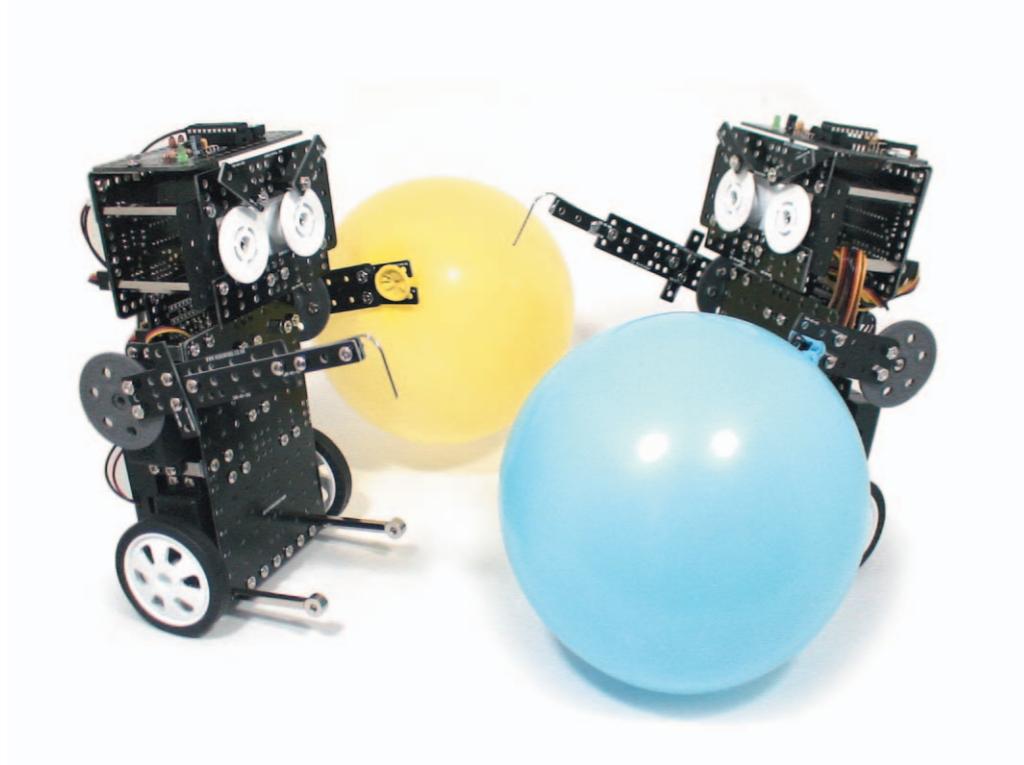
1. If I make a fish robot, where will I use it?

Example : My fish robot swims in broad Pacific Ocean and monitor the marine pollution instead of humans.



Teacher's Evaluation and Task	Teacher's Confirmation

# Work of the Day



**AxeBot** is a robot that puffs balloon as using its arm as an axe. Learn about a humanoid robot meaning a human-looking robot and compete who puffs an opponent's balloon first as moving its arm that is connected to the Servo Motor.

- ▶ Axe : a tool used for cutting wood
- ▶ Humanoid : similar to human

• • • Humanoid Robot • • •



(Curio of Japan)

Humanoid is a combined word from 'human' and 'oid' meaning 'similar to human'. It means a humanized robot and from robots to an alien, any kind of creature having a structure of the head, body, arm, legs etc and others, you can be called 'humanoid'.

Humanoid robots that are recently developed in Korea's KAIST team, Japan, America and all over the world, can walk and shake hands using joints like human.

Where can this humanoid robot be used? The Humanoid robot can help people having simple conversations or showing the way in the building or tourist spot. For this reason, a human-looking appearance is more familiar to us, isn't it? Also robots can do dangerous jobs in industrial settings and once they are ordered to work, they do nothing but work.



(Korea's Hubo)



(Japan's Asimo)

As you can see, the humanoid robot is very useful in many fields. Korean 'Hubo' and Japanese 'Asimo' can be representative humanoid robots.

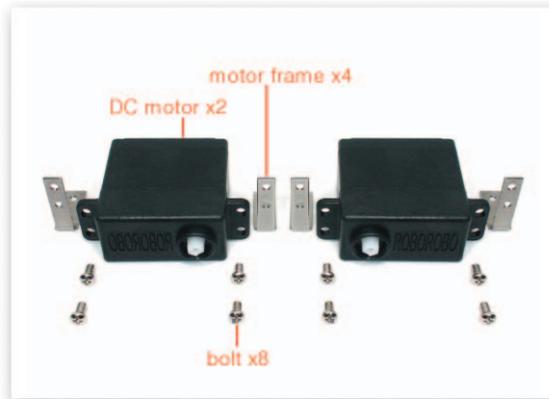
First, Korean 'Hubo' developed by KAIST, can move its body smoothly and can play rock, scissors and paper with separately movable fingers. It can dance blues with a human and shakes hands with a gentle grip by sensing the degree of strength.

Japanese 'Asimo', made by Honda, has a function of facial recognition which can distinguish a face so it can call out a names. Also one specific feature of 'Asimo' is that can climb stairs unlike other robots which can only move on the flat ground.

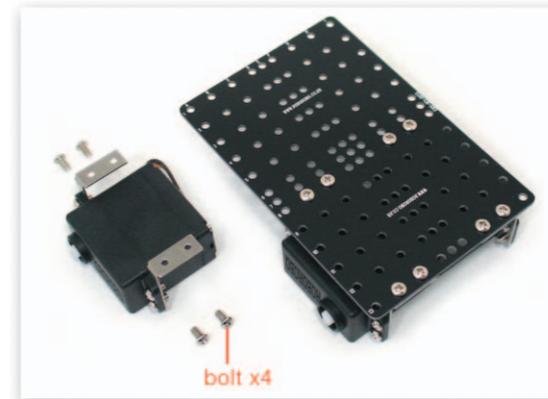
Humanoid robots in cartoons or movies provide human beings with the convenient life by doing dishes laundry, cleaning and other house-works instead of humans. However there are other concerns that a robot might break「3 Principles of Robot」like the movie 'I, Robot'. In the future, we should make technology better to develop a robot that is not possible to underrate humans.

# How to Assemble

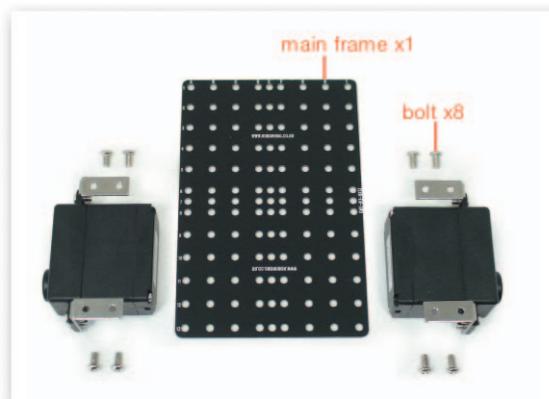
# AxeBot



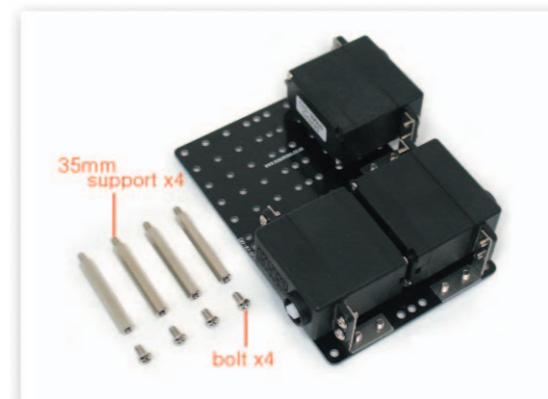
1 Fix the DC Motors and the Motor Frames with bolts.



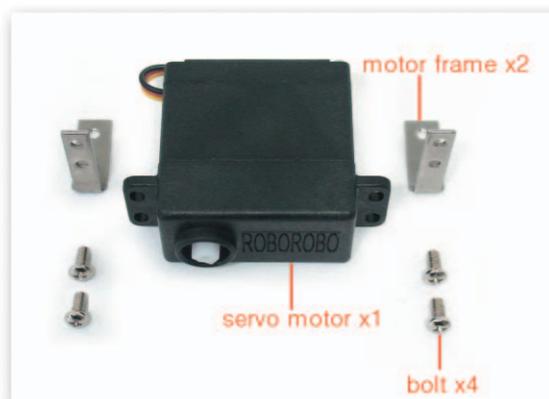
4 Fix the Motor Frame that is fixed to the Servo Motor to the Main Frame with bolts.



2 Fix the Motor Frame that is fixed to the DC Motor to the Main Frame with bolts.



5 Fix the 35mm Support to the Main Frame with bolts.



3 Fix the Servo Motor and the Motor Frames with bolts.

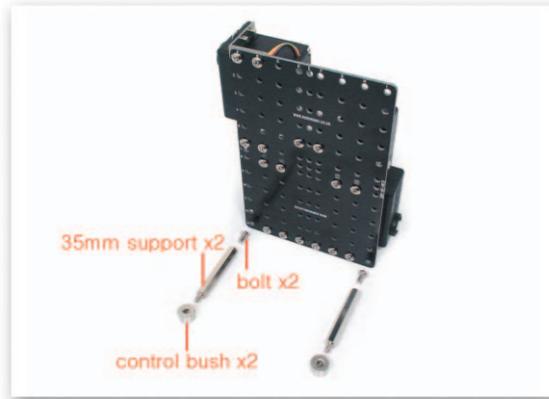


6 Put the Battery Case to the Support that is fixed to the Main Frame and fix with nuts and 35mm Support. Then fix the regulable nut to the 35mm Support.

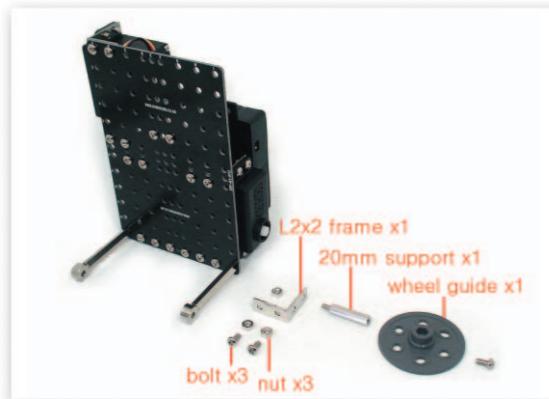


# How to Assemble

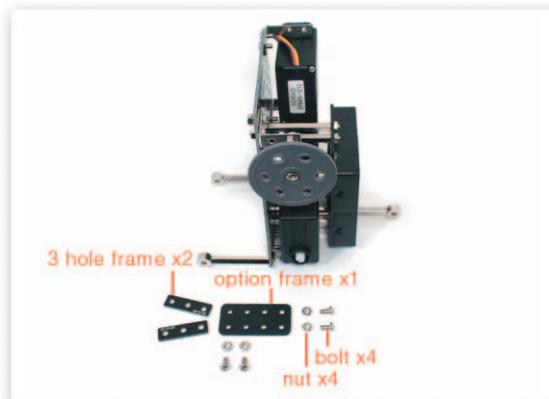
# AxeBot



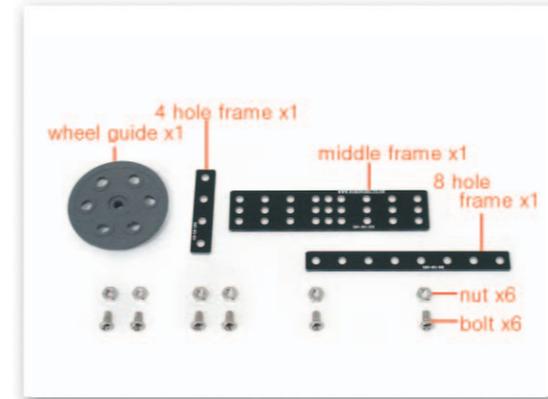
7 Fix the 35mm Support to the Main Frame with bolts. Then fix the regulable nut to the 35mm Support.



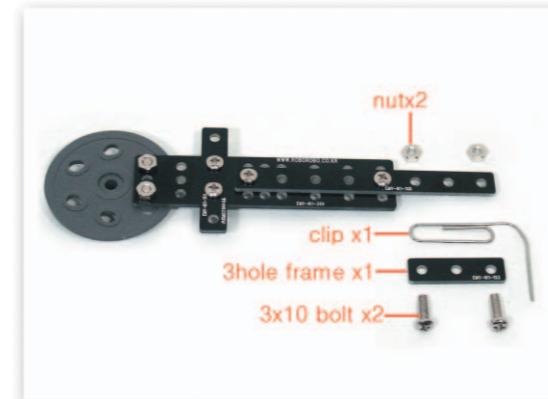
8 Connect the Wheel Guide to the L-type 2x2 Frame with the 20mm Support. And Fix the L-type 2x2 Frame to the Main Frame with bolts and nuts.



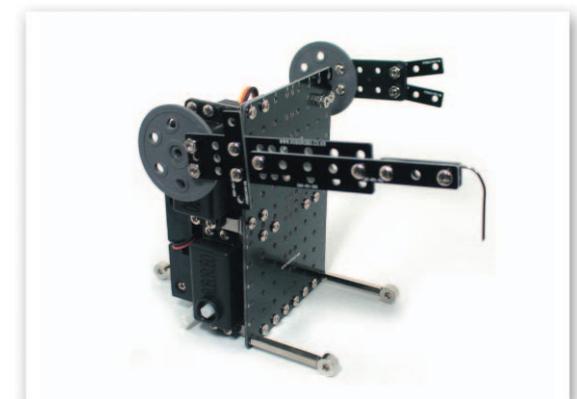
9 Connect the Small 3 Frames and the Option Frame with bolts and nuts and then fix to the Wheel Guide.



10 Connect the Wheel Guide and the Middle Frame and then put the Small 4 Frame and the Small 8 Frame on the Middle Frame then fix with bolts and nuts.



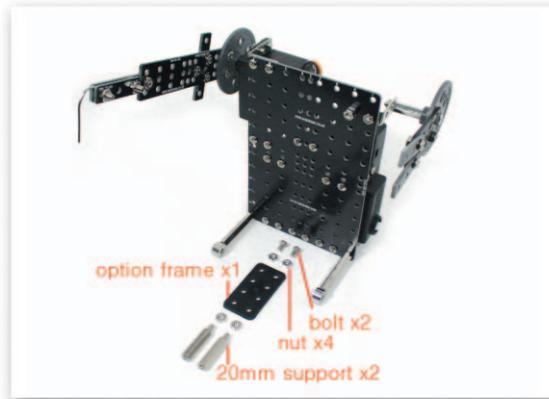
11 Insert a paper clip to the Wheel Guide of fixed arm to the Servo Motor axle.



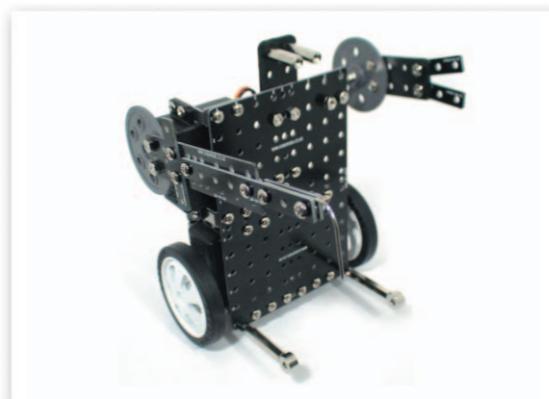
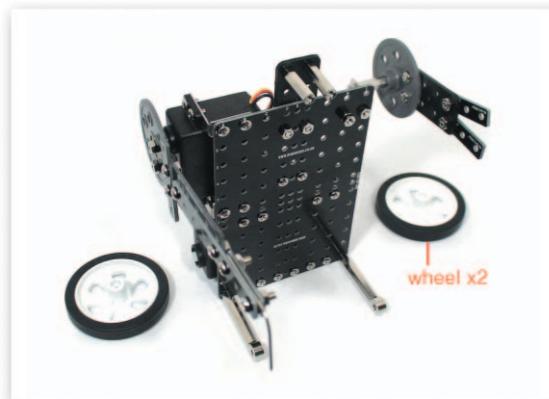
12 Put the paper clip between the Small 8 Frame and the Small 3 Frame and fix with the 3x10 bolts and then cut the end of the paper clip sharply with a nipper.

# How to Assemble

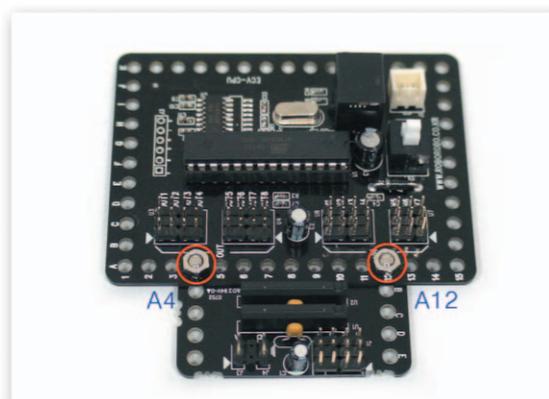
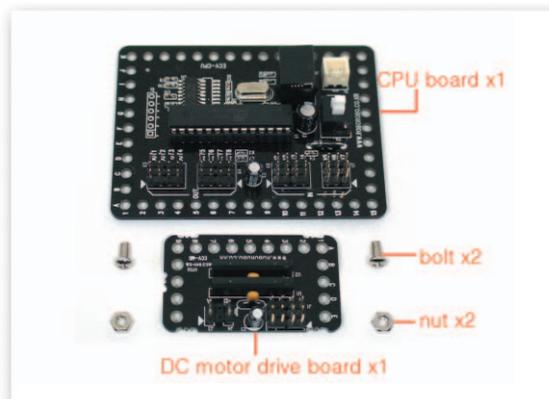
# AxeBot



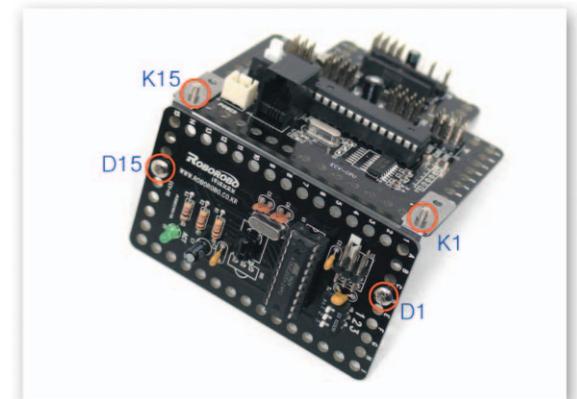
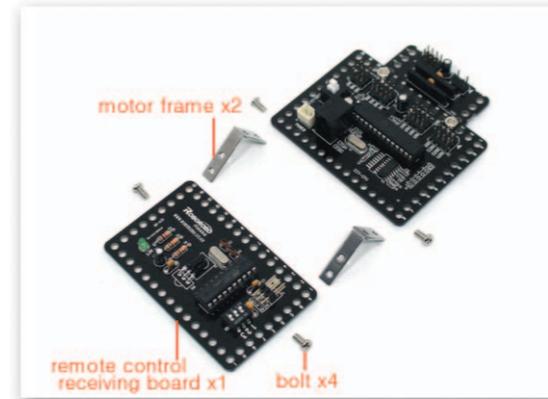
13 Fix the 20mm Supports to the Option Frame and then fix to the Main Frame with bolts and nuts.



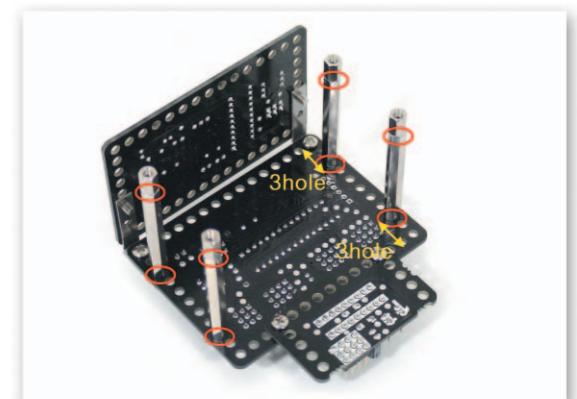
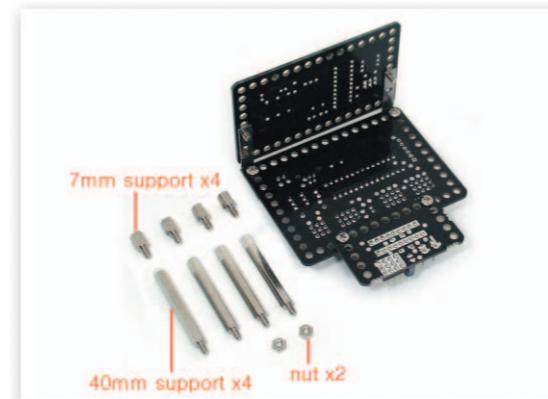
14 Insert the Wheels to the DC Motor axle.



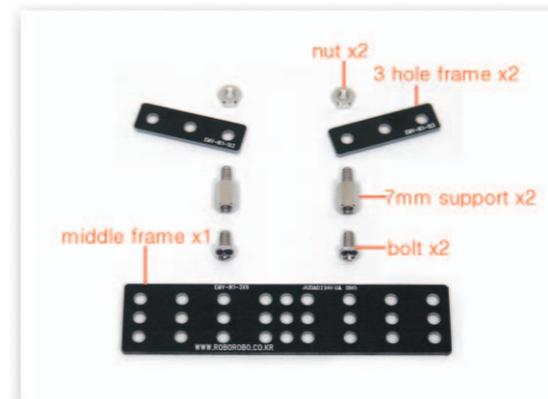
15 Fix the CPU Board and the DC Motor Drive Board with bolts and nuts.



16 Connect Remocon Remote Control Receiving Board and CPU Board with the Motor Frames.



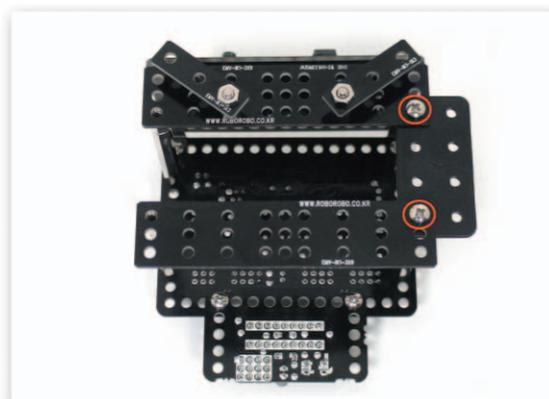
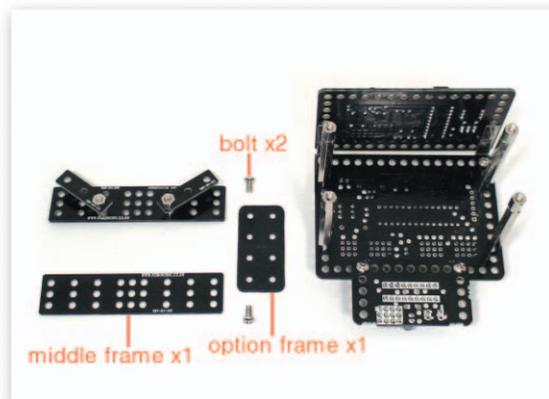
17 Connect the 40mm Support and the 7mm Support and then fix to the CPU Board.



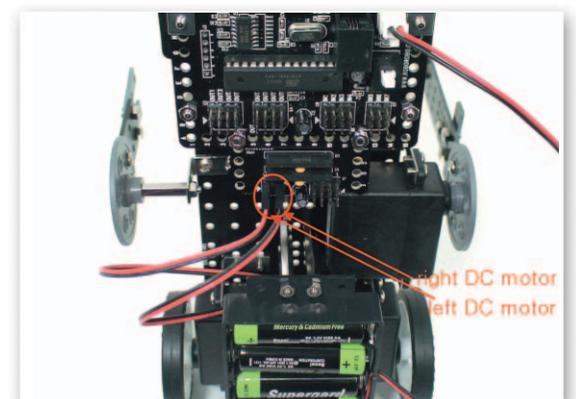
18 Fix the 7mm Support to the Middle Frame with bolts and then put the Small 3 Frame on the 7mm Support and fix with nuts.

# How to Assemble

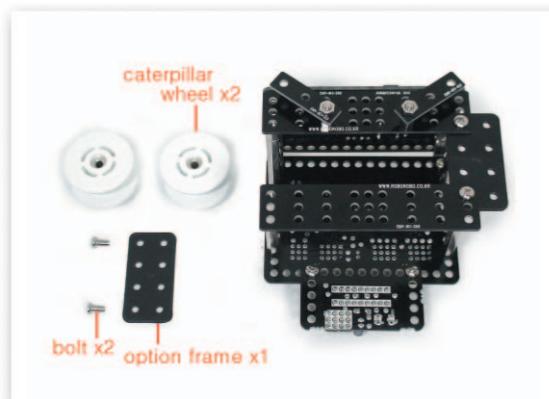
# AxeBot



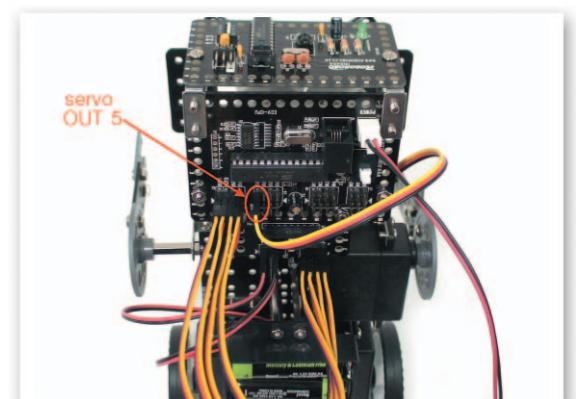
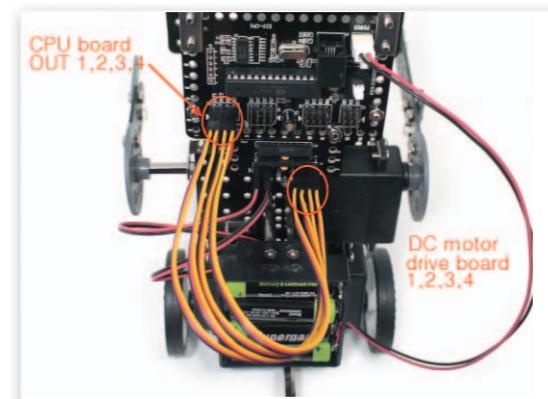
19 Put the Middle Frame that eye brows are fixed to the newly prepared Middle Frame and the Option Frame on the Support that is fixed to the CPU Board and fix them with bolts.



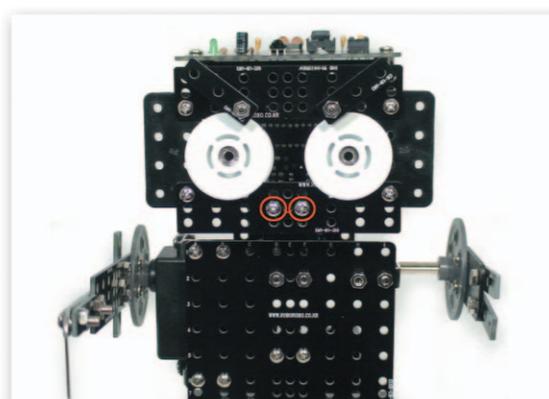
22 Connect the Power cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A, B.



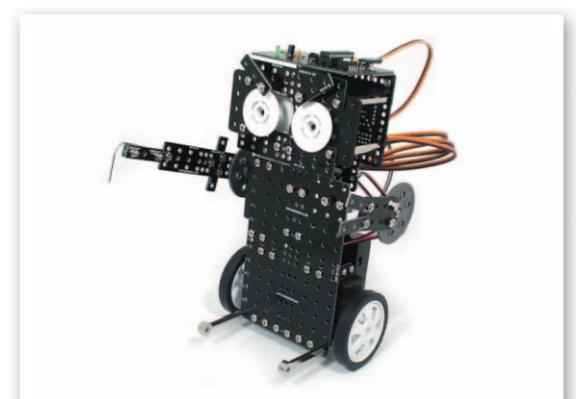
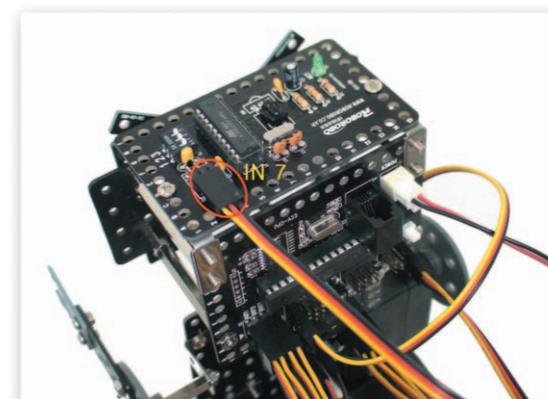
20 Insert the Caterpillar Wheel Guides between the Middle Frames and then put the Option Frame on the Support that is fixed to the CPU Board and fix with bolts to make a face.



23 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and the DC Motor Drive Board 1, 2, 3, 4. Connect the Servo Motor cable to OUT Port 5 of the CPU Board.



21 Fix the AxeBot face to the Support that is fixed to the Option Frame with bolts.



24 Connect the 3 Pin Cable to IN Port 7 of the CPU Board and the Remote Control Receiving Board. Completed AxeBot.

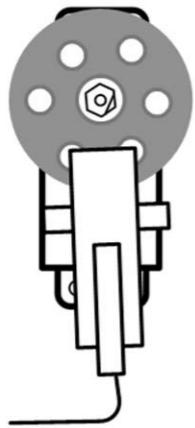
# Explain the Program

AxeBot

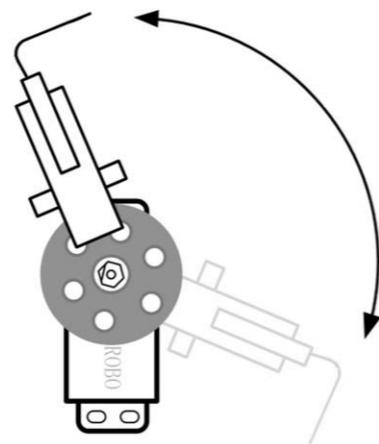
## Set up Servo Motor

- Main Main Function : Setting the starting point and the rotation position.
- Application : Set the zero point and then insert the Motor Guide on a position of setting up starting point and set the rotating position with the Servo Motor Chip.

[Position of Setting the Starting Point]

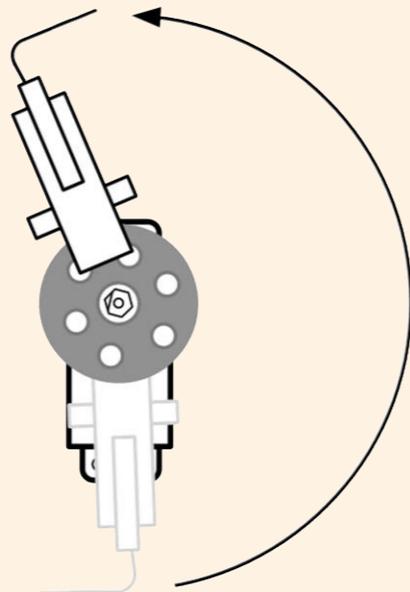


[Radius of Rotation]



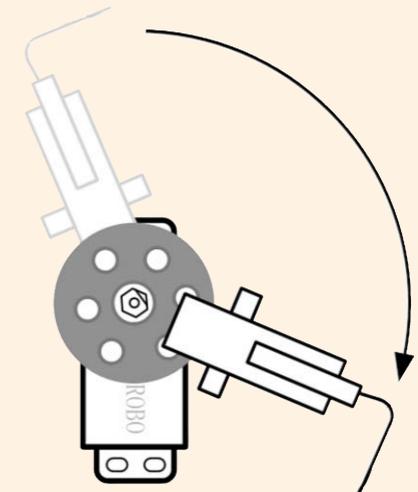
### Try This!

Set the Servo Motor Chip to make a robot to lift its arm.



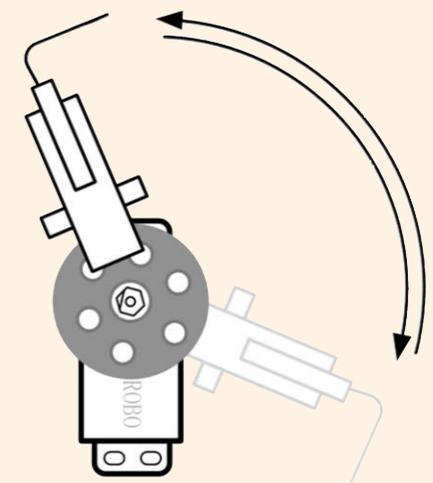
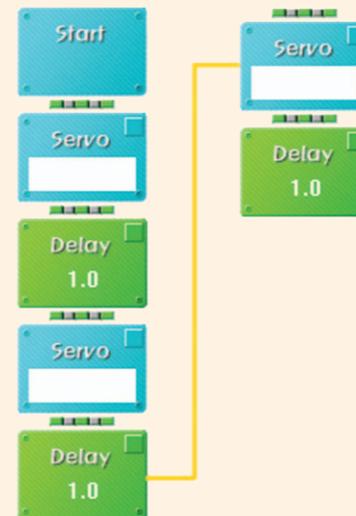
### Try This!

Set the Servo Motor Chip to make a robot to put down its arm to puff the balloon.



### Try This!

Set the Servo Motor Chip to make a robot to lift up and down its arm to puff the balloon then lift up again.





# Shall we make it move?

# AxeBot

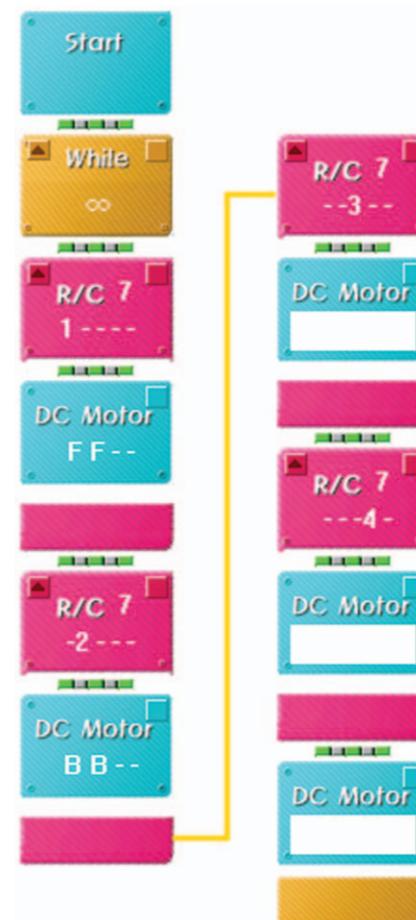
**1** Try to lift up and down the robot's arm to puff a balloon when pressing the Wireless Remote Control 5.



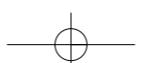
**2** Make the robot's arm move often than Program 1.



**3** Try to move forwards when pressing the Wireless Remote Control 1, move backwards with 2, turn left with 3 and turn right with 4.



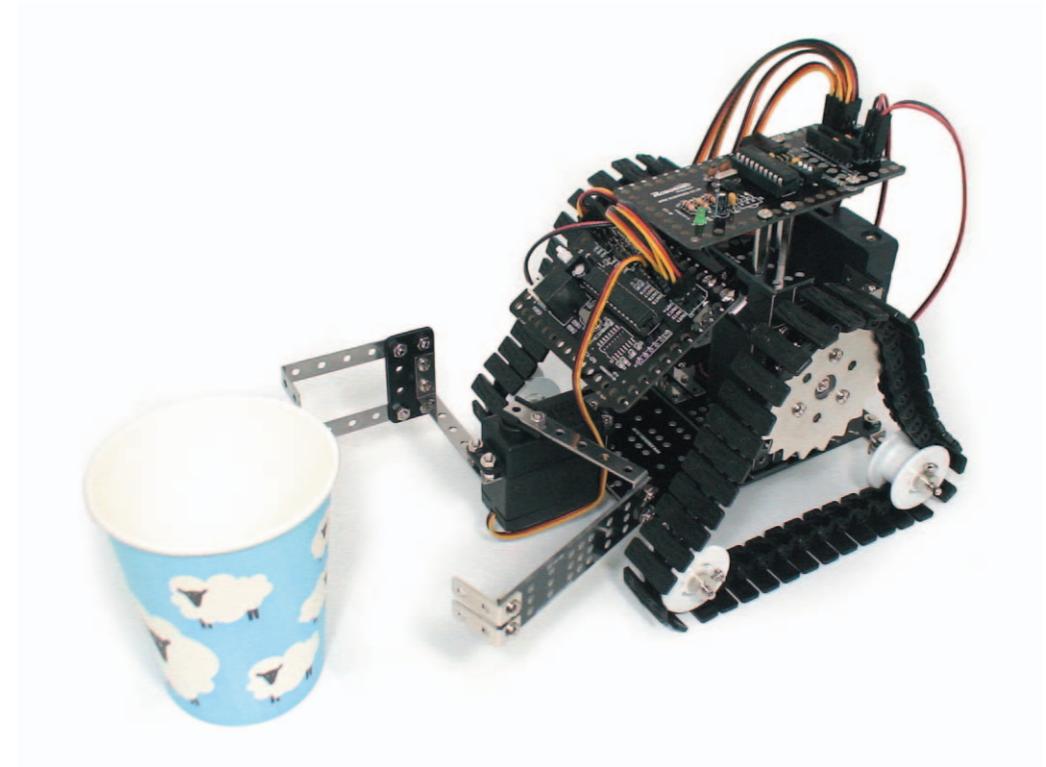
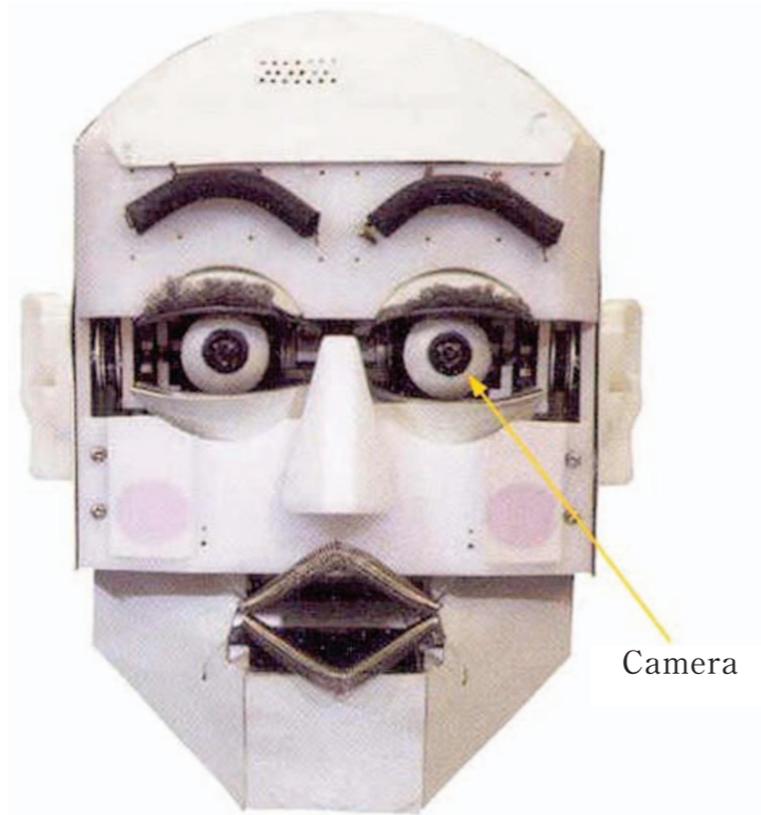
**4** Insert the balloon on the left arm and then compete who puffs the opponent's balloon first using the Wireless Remote Control.



# What did you learn?

# Work of the Day

1. What sensors are necessary for the following face of the humanoid to function like a human face?

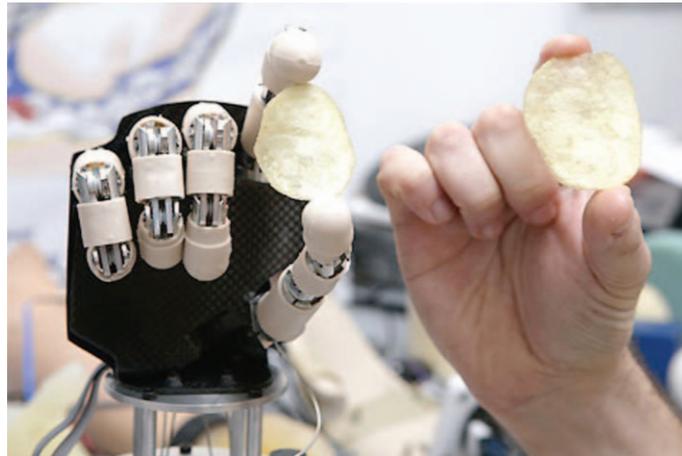


**GrabBot** is a robot that can grab things. Let's learn the principle of robot hands and compete who moves more things controlling Grabbot with the Wireless Remote Control.

.....  
▶ Grab : seize, grasp, snatch, take hold of

Teacher's Evaluation and Task	Teacher's Confirmation

• • • Robot Hand • • •

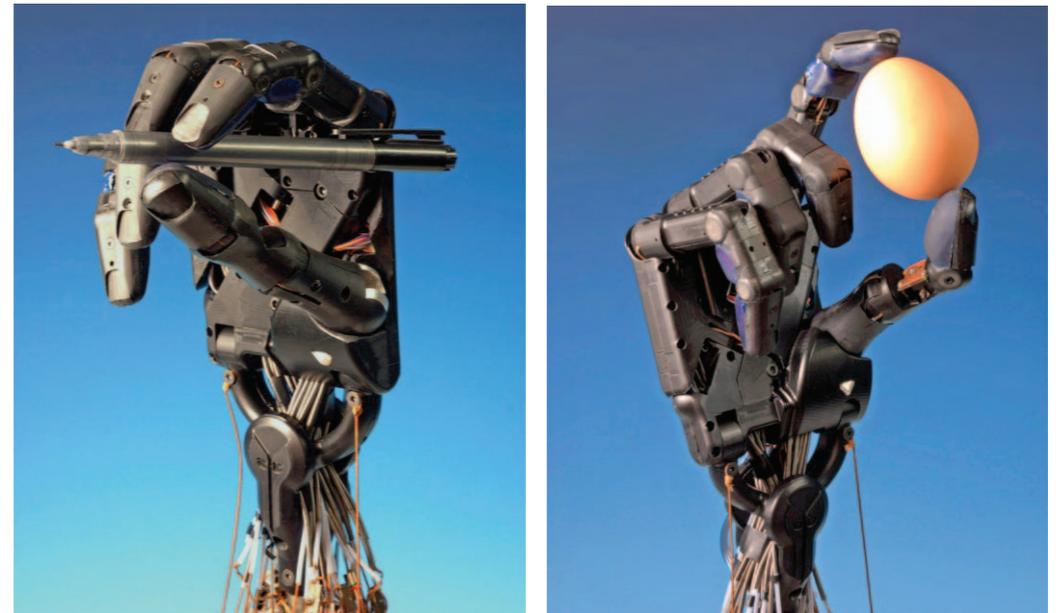


(Cyber Hand)

A robot needs a humanized robot hand such as a humanoid to work like real hume. Therefore the robot has been developed more intelligently than past robot only having simple functions like welding. For example, a cyber hand, an artificial hand, can be moved by brain waves to make patients who lost their hands feel like moving their own hands.

The Cyber hand is combined with a computer system and mechanical equipment. The computer system is to receive and save the brain wave signals of an artificial hand wearer. With the combination of this technique, the wearer can move the artificial hand like the part of his/her body.

The sense interface is implanted to user's arm, which functions as a translator between human and machine. That is, this sense interface transfers electrical signals between the central nervous system and the artificial hand.



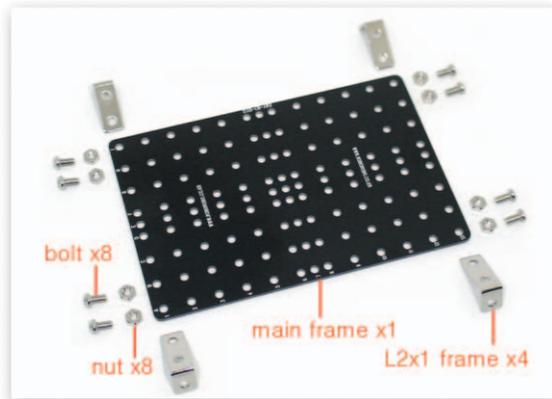
(Robot Hand of Shadow Robot Company)

The Cyber hand can move five fingers separately with the DC Motor that is built in each finger. Each motor pulls the cable which functions like a human's strain and muscle. Therefore actions like grabbing a mug with fingers can be possible when the motor pulls the cable. Meanwhile, thanks to the pressure sensor that is built in the surface of the finger, the hand can pick up a thing without breaking.

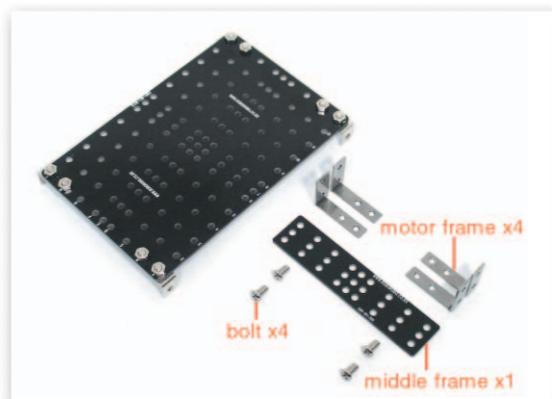
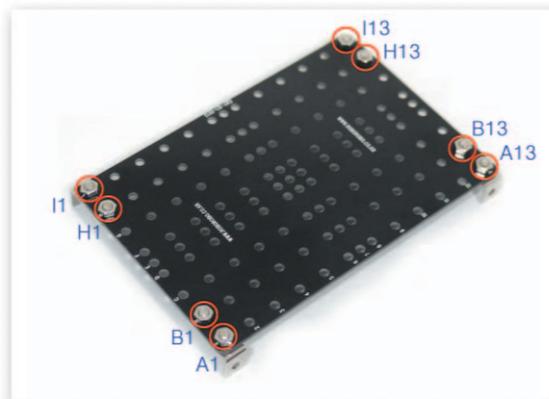
As you can see, robot technology is developing rapidly. It is not a dream anymore to see an artificial hand like the cyber hand such as a surgery with a robot hand. Why don't we make practical GrabBot useful for people?

# How to Assemble

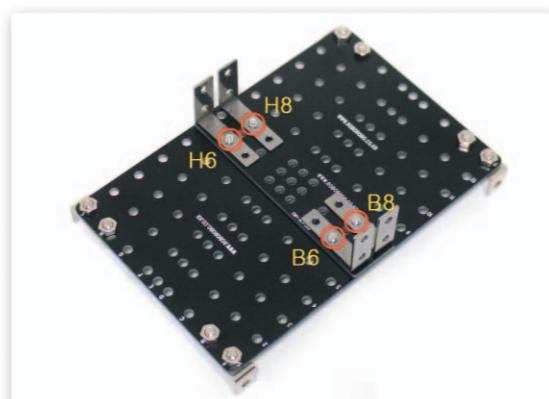
# GrabBot



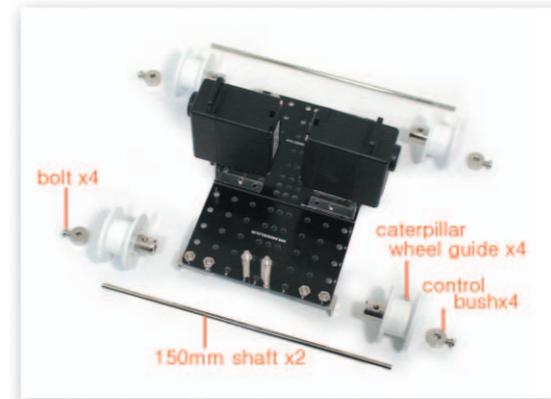
1 Put the L-type 2x1 Frames under the Main Frame and fix with bolts and nuts.



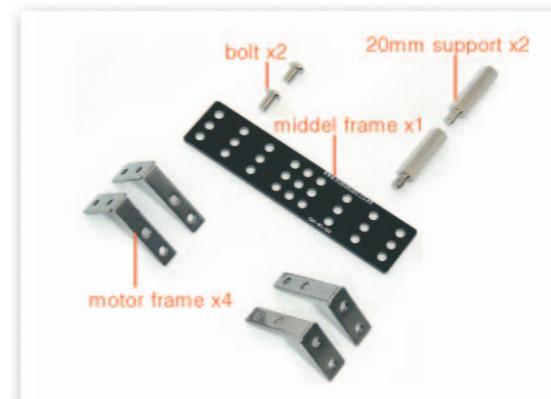
2 Put the Middle Frame and Motor Frames on the Main Frame and fix with bolts.



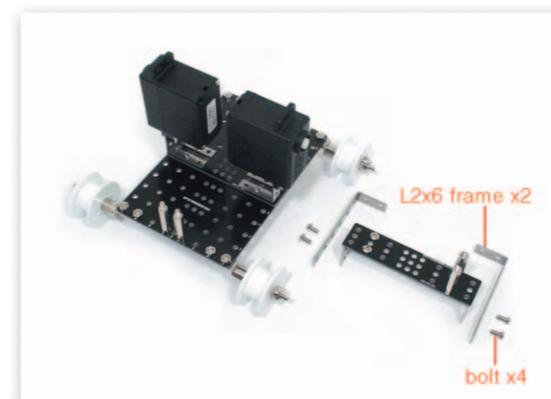
3 Fix the DC Motors to the Motor Frames with bolts and then fix the 20mm Support to the Main Frame with bolts.



4 Insert the 150mm axle to the L-type Frames that are fixed to the Main Frame and then insert the Caterpillar Wheel Guide to both sides. And insert regulable nuts and fix with bolts.



5 Fix the Motor Frames and the Middle Frame with bolts and the 20mm Supports.

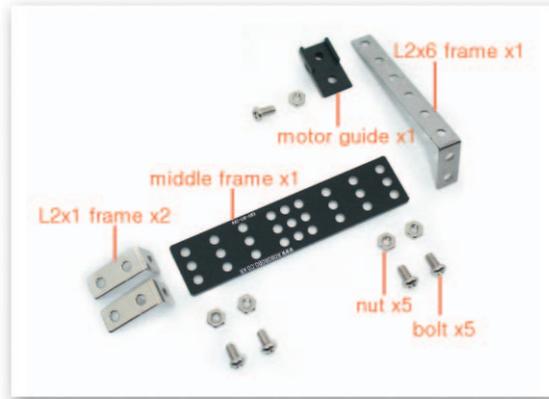


6 Fix the Motor Frame that is fixed to the Middle Frame and the L-type 2x6 Frames to the Servo Motor with bolts.

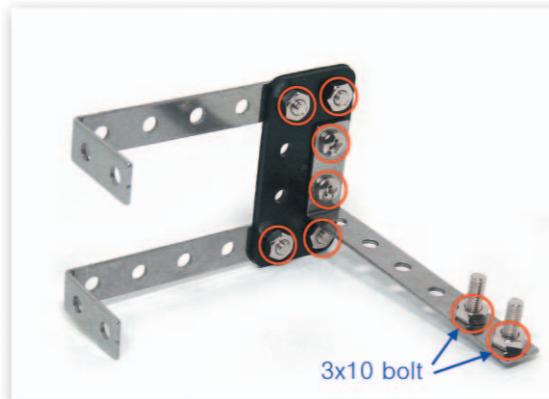
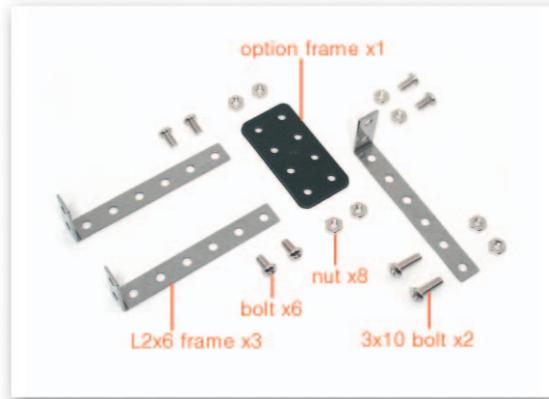


# How to Assemble

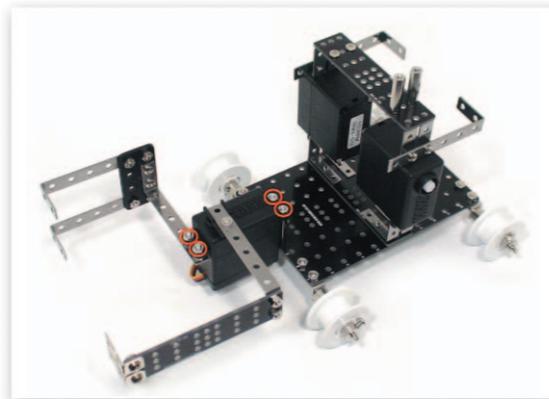
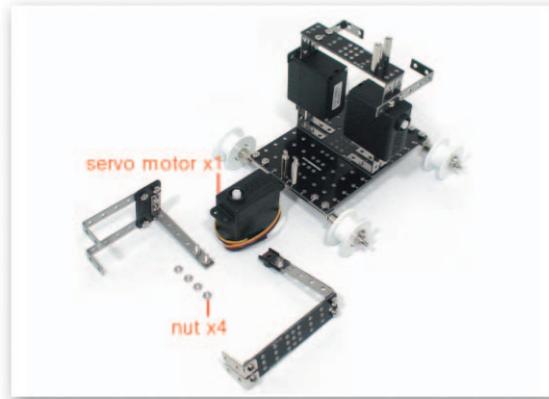
# GrabBot



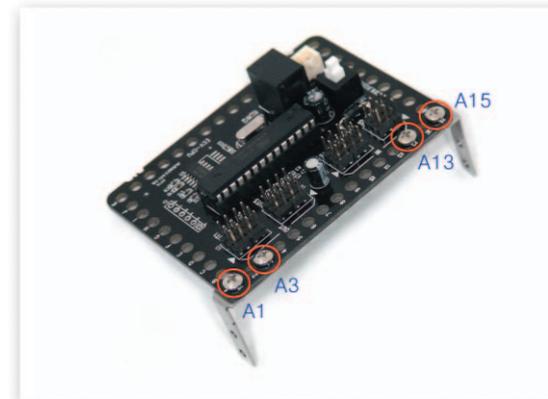
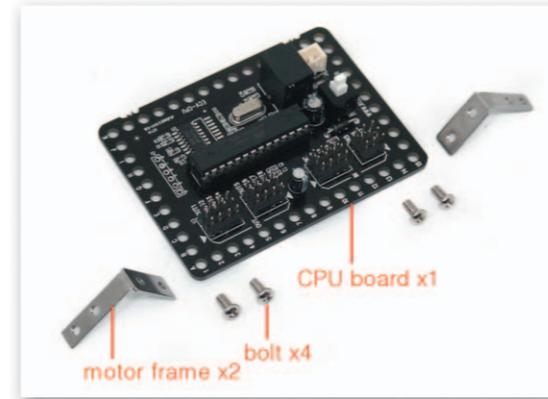
7 Fix the Motor Guide to the L-type 2x6 Frame with bolts and nuts. And Fix the L-type 2x1 Frames and the L-type 3x6 Frames to the Middle Frame with bolts and nuts to make a left grab.



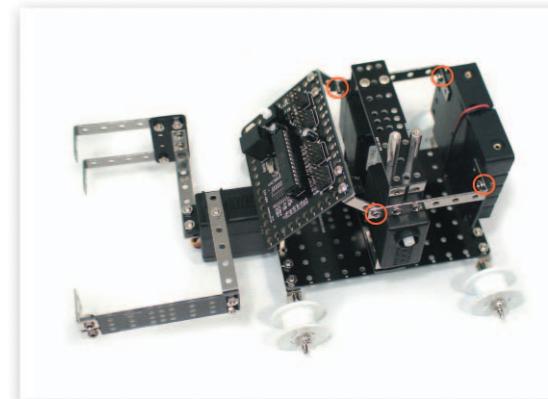
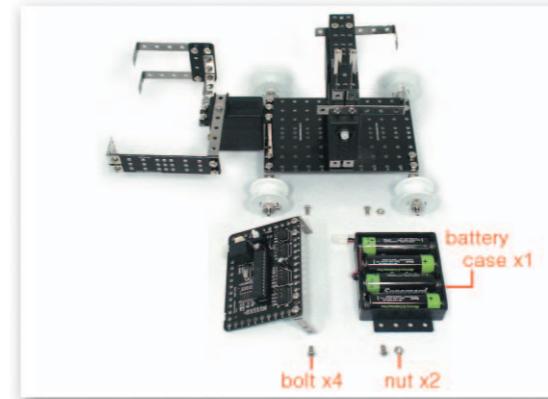
8 Fix the L-type 2x6 Frames to the Option Frame. And fix the 3x10 bolts to L-type 2x6 Frame to make a right grab.



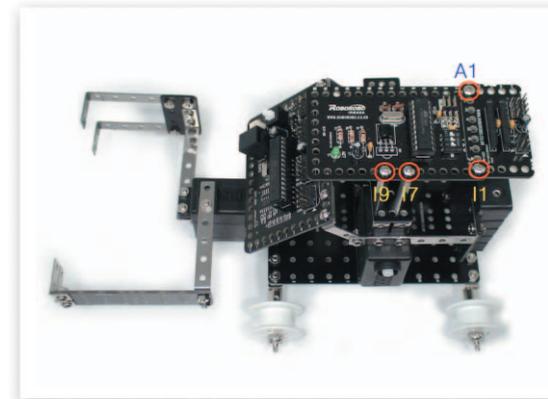
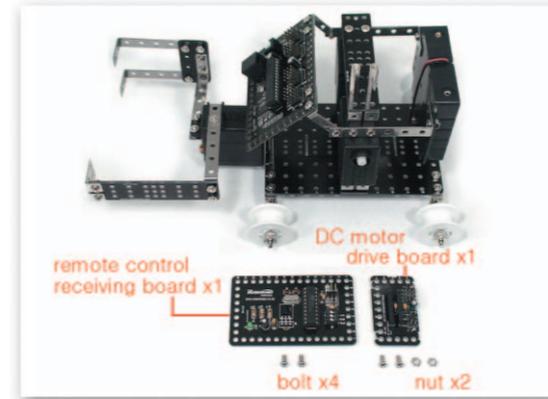
9 Fix the Servo Motor to the Support that is fixed to the Main Frame with nuts. And fix the 3x10 bolts of the right grab to the Servo Motor with nuts and insert the Motor Guide of the left grab to the Servo Motor axle.



10 Fix the CPU Board and the Motor Frames with bolts.



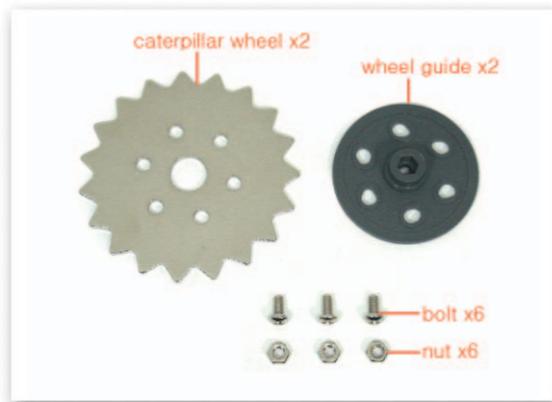
11 Fix the Motor Frames that are fixed to the CPU Board to the L-type Frame with bolts and then fix the Battery Case to the L-type Frame with bolts and nuts.



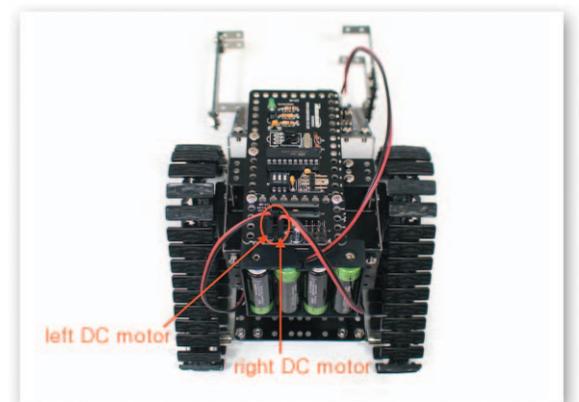
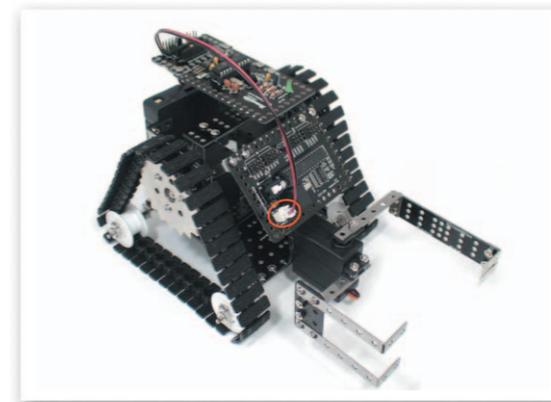
12 Connect the Wireless Remote Control Receiving Board and the DC Motor Drive Board with bolts and nuts and then put the Remote Control Receiving Board on Support and fix with bolts.

# How to Assemble

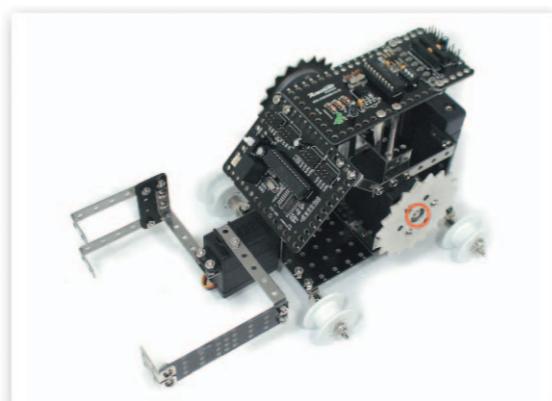
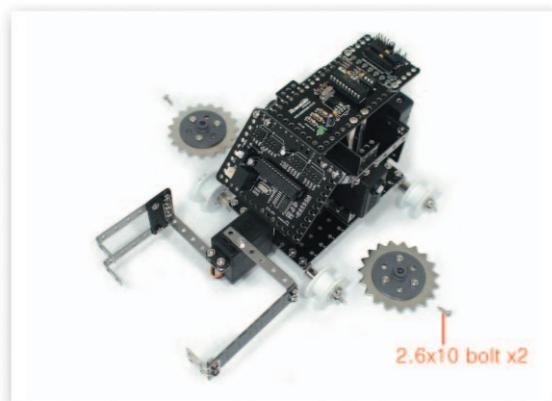
# GrabBot



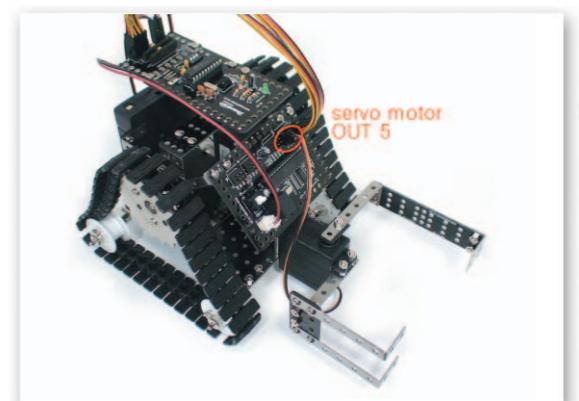
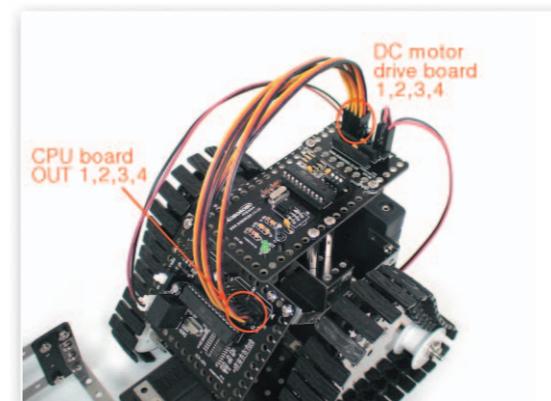
13 Put the Wheel Guides on the Caterpillar Wheels and fix with bolts and nuts.



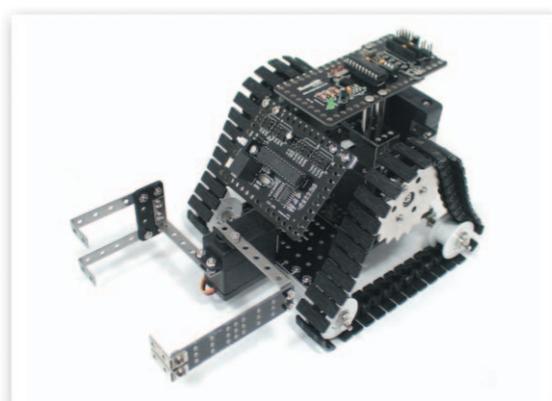
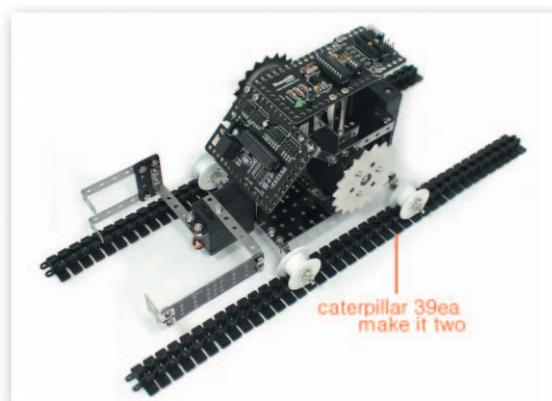
16 Connect the Power cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A, B.



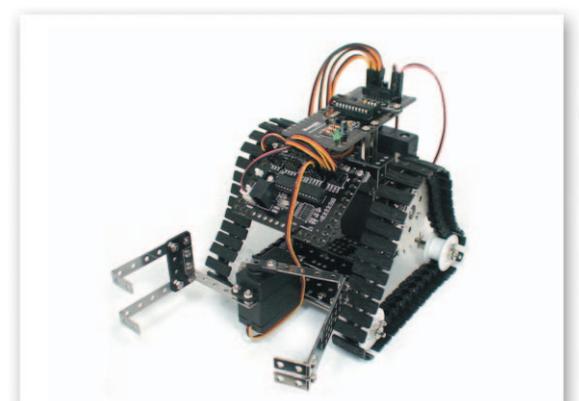
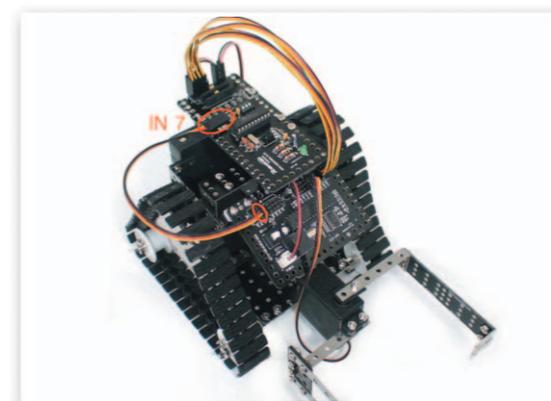
14 Insert the Wheel Guides that are fixed to the Caterpillar Wheels to the DC Motor axle then fix with the 2.6x10 bolts.



17 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and the DC Motor Drive Board 1, 2, 3, 4. Connect the Servo Motor cable to OUT Port of the CPU Board.



15 Connect the Caterpillars (2 lines with 39 each) and fix to the Caterpillar Wheels and the Caterpillar Wheel Guides.



18 Connect the 3 Pin Cable to IN Port 7 of the CPU Board and the Remote Control Receiving Board.

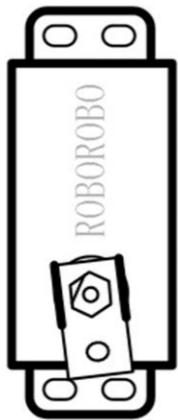
# Explain the Program

# GrabBot

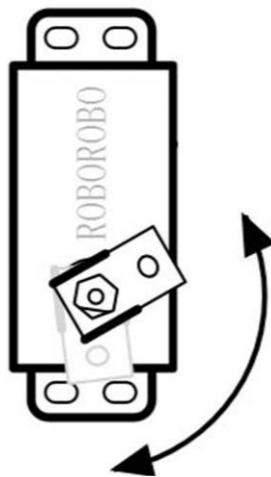
## Set the Servo Motor

- ain Function : Setting the starting point and rotation position.
- sing Method : Set the zero point and then insert the Motor Guide on the position of setting starting point and set the rotating position with the Servo Motor Chip.

[Position of Setting the Starting Point]

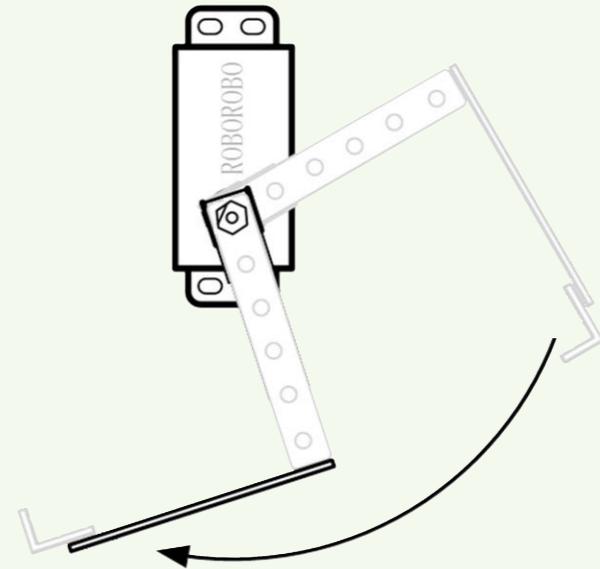


[Radius of Rotation]



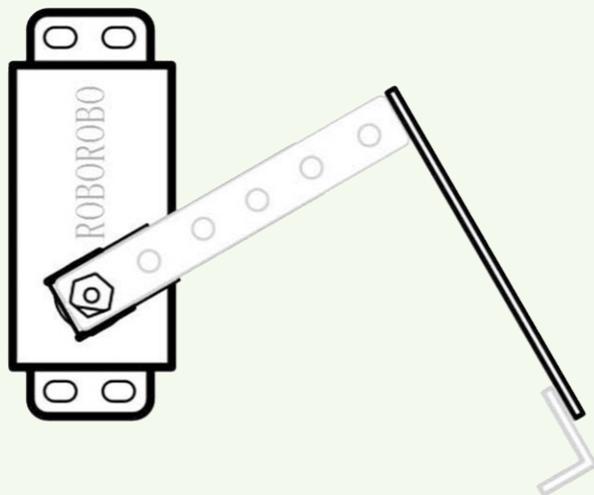
### Try This!

Set the Servo Motor Chip to close up the grab to hold a thing.

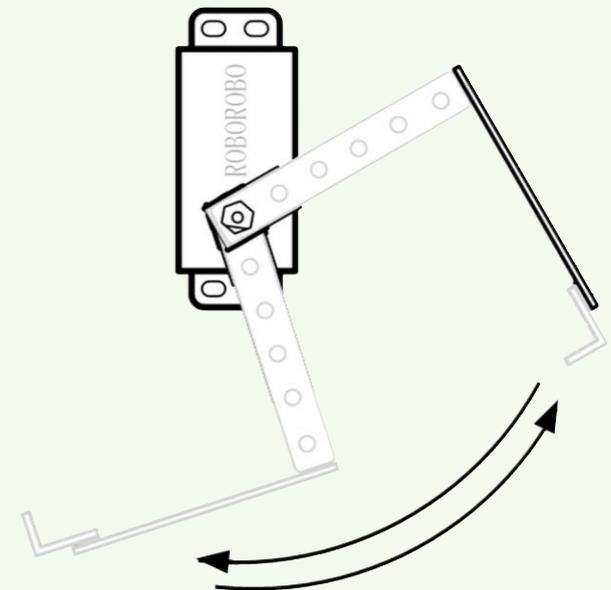
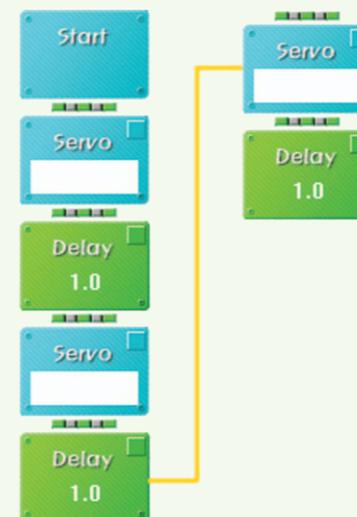


### Try This!

Set the Servo Motor Chip to open the grab.



Set the Servo Motor Chip to open, close up and open the grab again.



# Shall we make it move?

# GrabBot

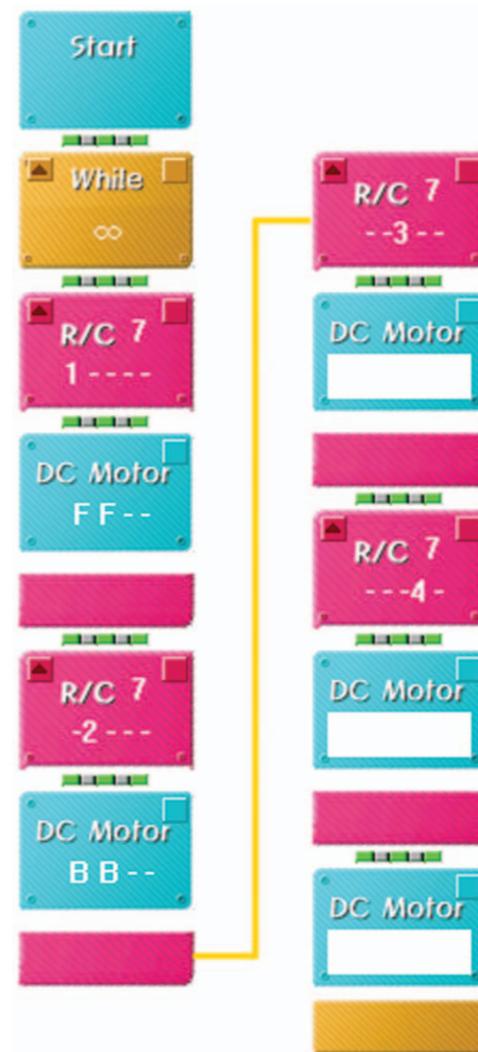
1 Try to repeat the motion that opens and closes up the grab continuously.



2 Try to open the grab when pressing the Wireless Remote Control 1, 5 and to close up with 2, 5.



3 Try to move forwards when pressing the Wireless Remote Control 1, move backwards with 2, turn left with 3 and turn right with 4.

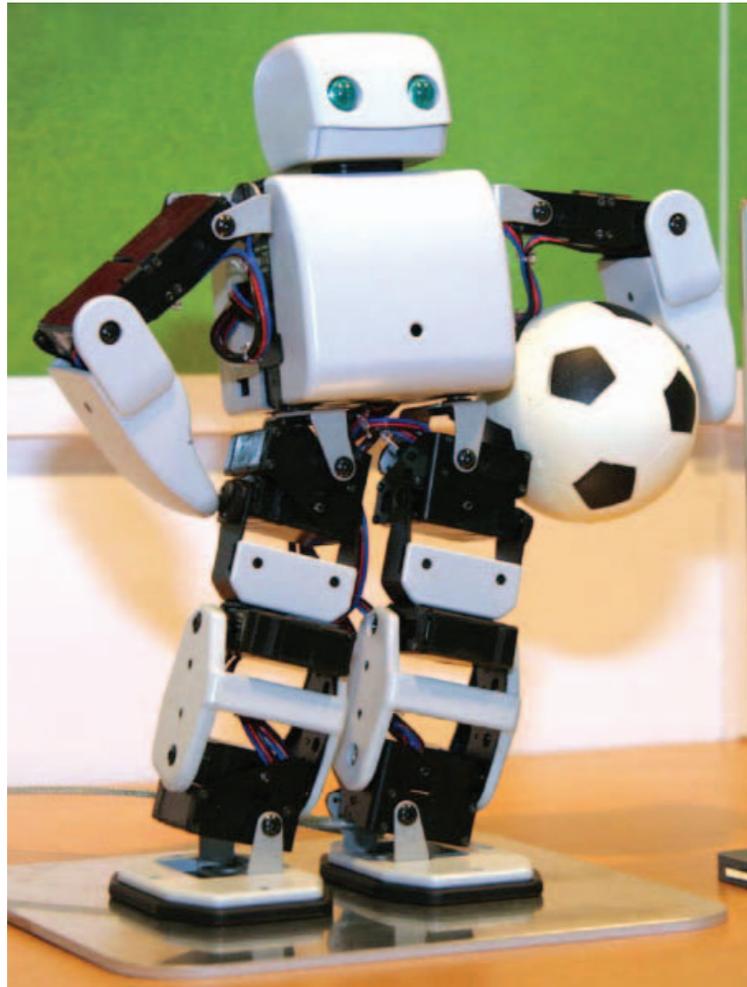


# What did you learn?

# Work of the Day

1. A Two-legged walking robot usually uses the Servo Motor to move like humans. How many Servo Motors are necessary for the natural motion?

Teacher's Creatice Robot Competition  
CHOI Eunjo Tr.'s Work



**WheelchairBot** is a robot that looks like a wheelchair to help the disabled. Learn about high-tech products for the aged and the disabled like wheelchairs and move WheelchairBot using the Contact Sensor Board as joystick!

Teacher's Evaluation and Task	Teacher's Confirmation

- ▶ wheelchair : a chair with wheels that you use in order to move about in if you cannot walk properly, for example because you are disabled or sick.
- ▶ joystick : the lever which the player uses in order to control the direction of the things on the screen

• • • High-tech Products for the aged and the disabled • • •



(Electric Wheelchair)

The population ages rapidly and about 12% of the population have a mental and physical disorder globally and the outlook shows that this number will grow continuously. And the robots helping these people are actively being developed. Yet generalized but a robot that has loaded encyclopedia to Brain wave keyboard which uses brain waves to tell variety of knowledge followed by the voice of blind people is an example.

Recently developed Mouse Wheelchair System is a technology for the disabled who cannot use hands and feet freely due to spin injuries and this system make it possible to control the wheelchair with simple operation. They can also control the mouse or wheelchair by a headband type of the measuring system that transfers minute signals from near both temples of forehead like biting a molar tooth or touching teeth to a laptop wirelessly.



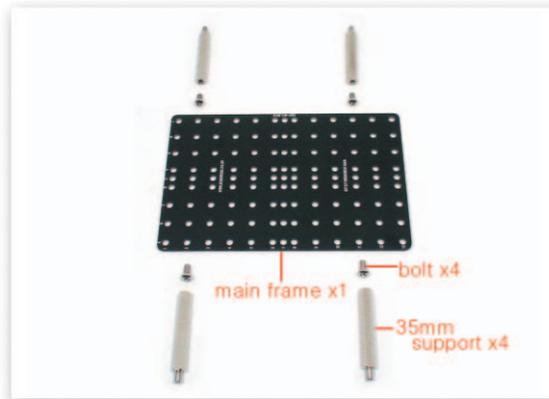
(Brain Wave Keyboard and Wearing Robot)

Also there is a robot that helps who has difficulty in carrying him or herself. Wearing robot is fitting to legs like walking supporters for the disabled and this moves as a computer operates a motor near knees and hips.

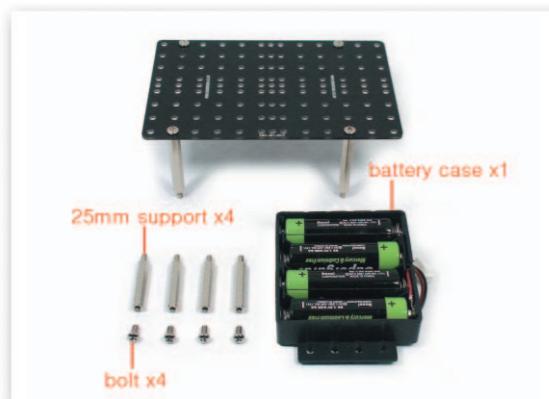
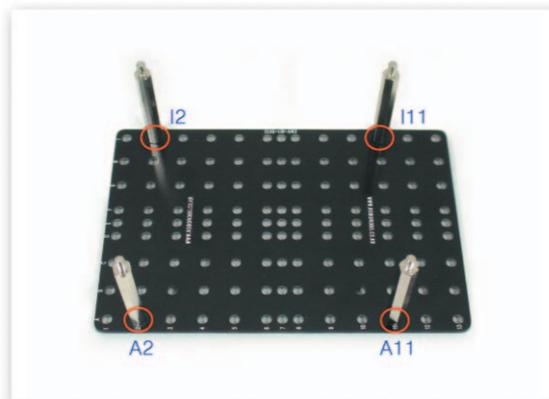
As you can see, starting from simple services like providing information, as hands and arms that feel like human are added to the robot the robot that can be perfect hands and legs for the disabled and the aged will appear in a few years. How about designing a robot for disabled or aged people?

# How to Assemble

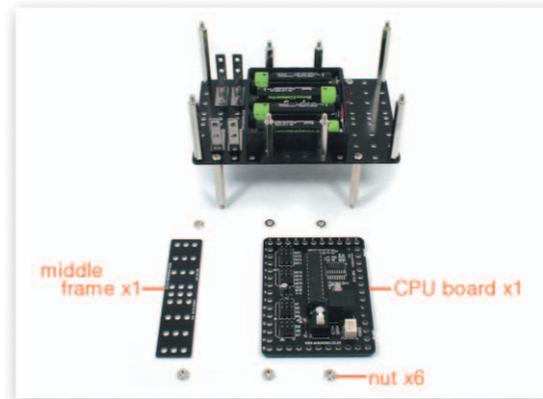
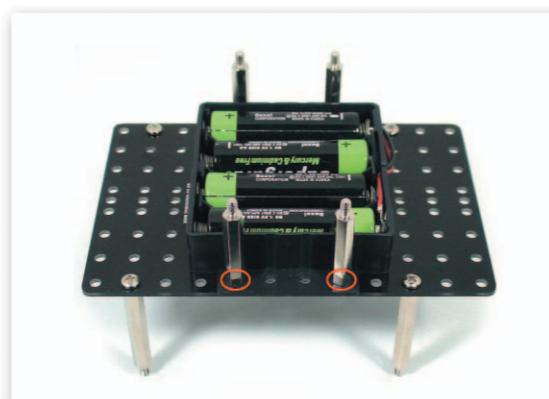
# WheelchairBot



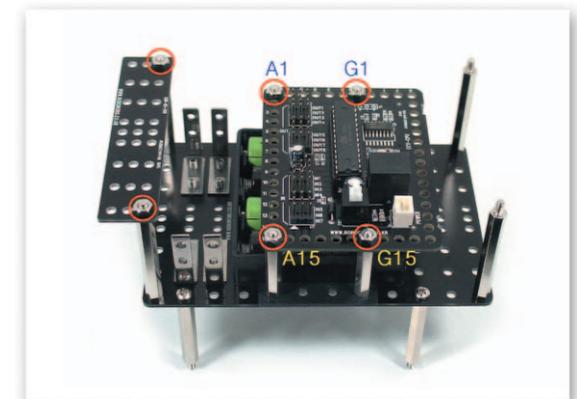
1 Fix the 35mm Supports to the Main Frame with bolts.



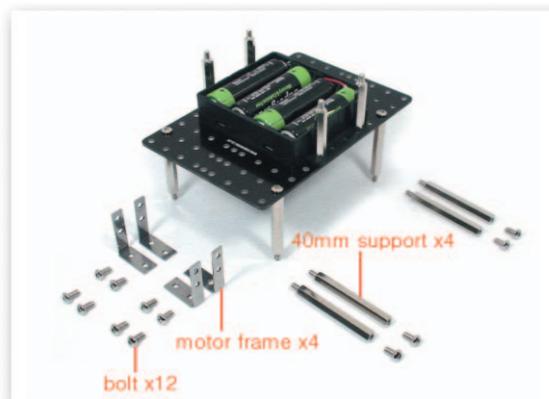
2 Put the Battery Case on the Main Frame and fix with the 25mm Supports and bolts.



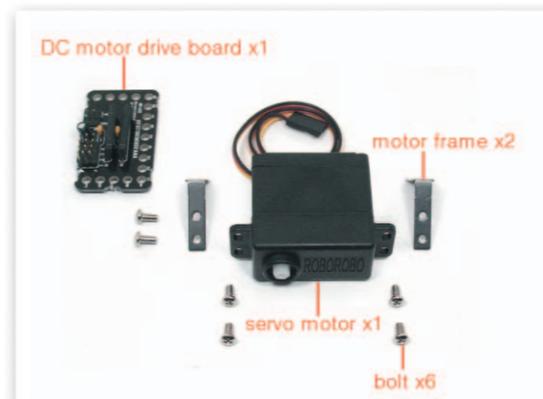
4 Put the Middle Frame and the CPU Board on the Support and fix with nuts.



5 Fix the DC Motors to the Motor Frames that is fixed to the Main Frame with bolts. And Insert the 35mm Supports to the Support that is fixed to the Main Frame then fix controllable nuts.



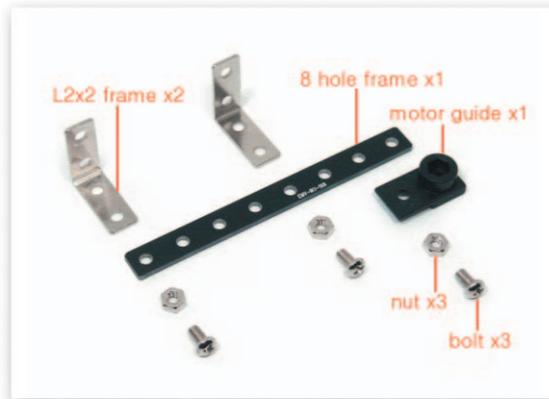
3 Put the Motor Frames and the 40mm Supports on the Main Frame and fix with bolts.



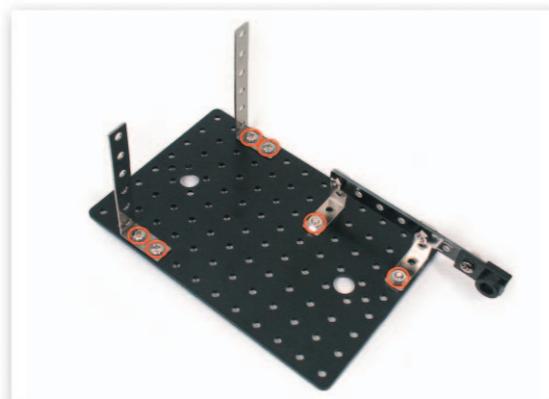
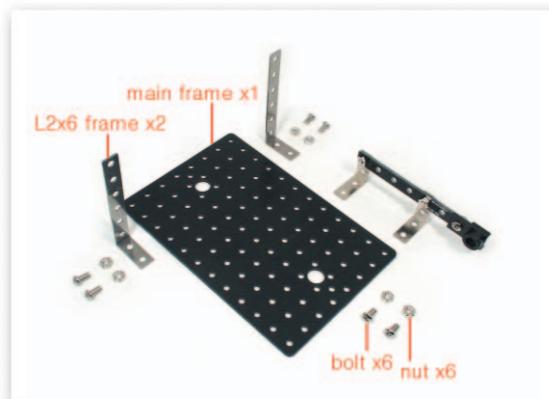
6 Fix the Servo Motor and the Motor Frames with bolts and then put the DC Motor Drive Board on the Motor Frame and fix with bolts.

# How to Assemble

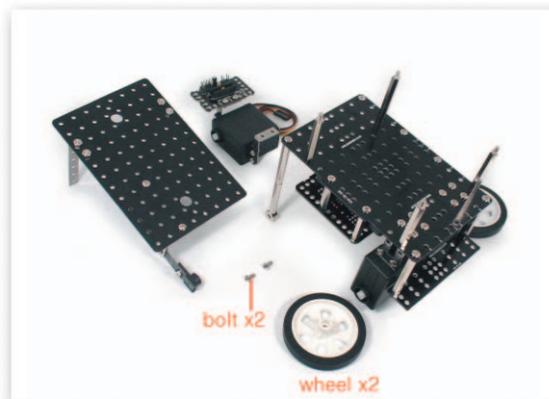
# WheelchairBot



7 Connect the Small 8 Frame and Motor Guide and then fix the L-type 2x2 Frames and the Small 8 Frame with bolts and nuts.



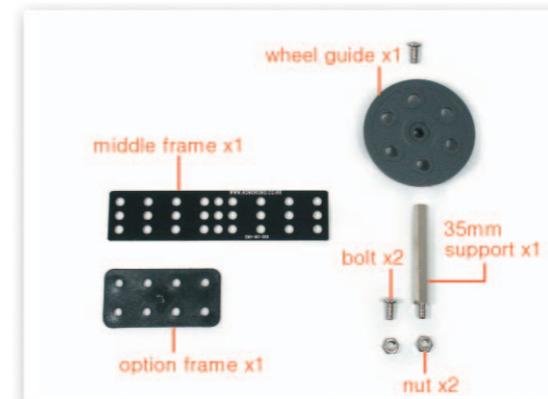
8 Put the L-type 2x6 Frame and the L-type 2x2 Frame that the Small 8 Frame is fixed, on the Main Frame and fix with bolts and nuts



9 Fix the Servo Motor under the Main Frame with bolts and then insert the Motor Guide to the Servo Motor axle. And insert the Wheels to the DC Motor axle.



10 Overlap the Contact Sensor Board and fix with bolts and nuts then fix the 5mm Supports with nuts.



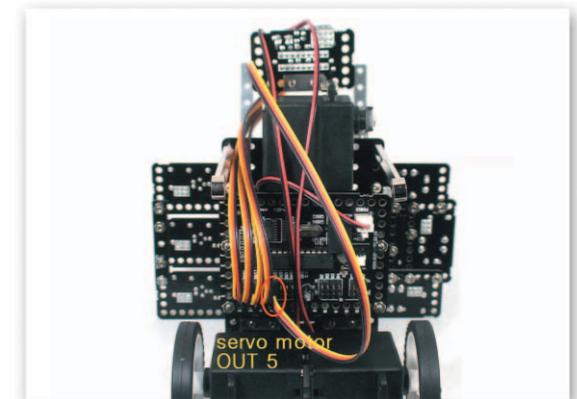
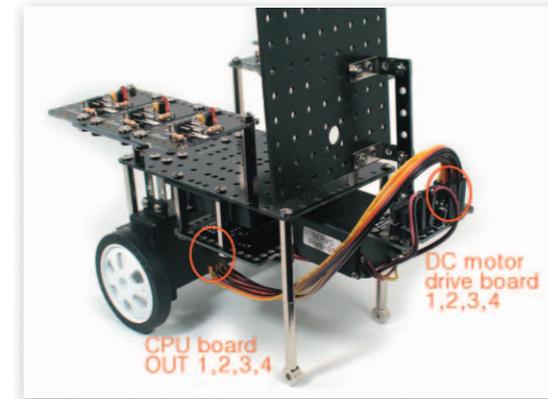
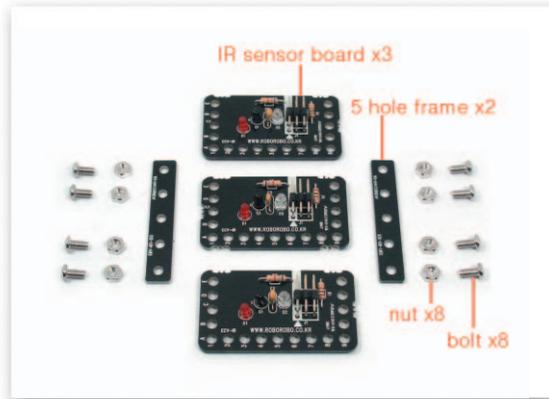
11 Fix the Wheel Guide and the 35mm Support with bolts. And overlap the Middle Frame and the Option Frame then fix with the Support that the Wheel Guide is fixed, bolts and nuts.



12 Put the Middle Frame on the Support that is fixed to the Contact Sensor Board and fix with the 3x10 bolts.

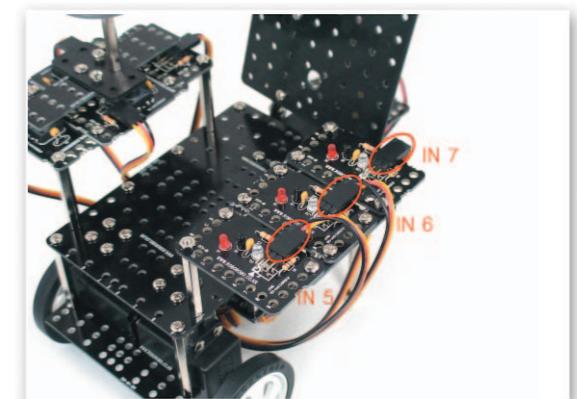
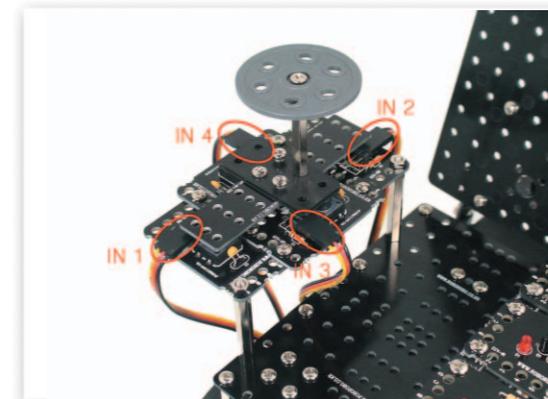
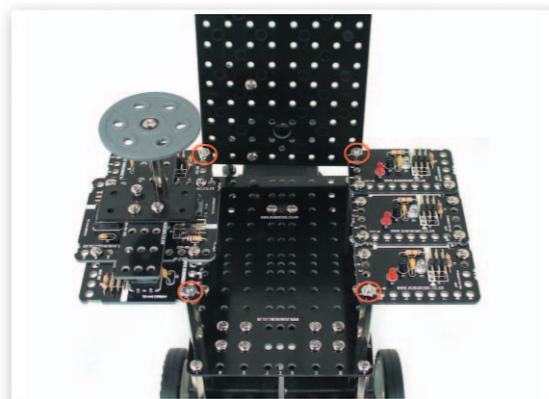
# How to Assemble

# WheelchairBot



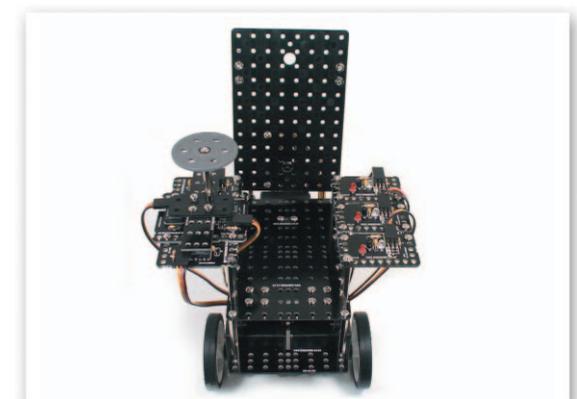
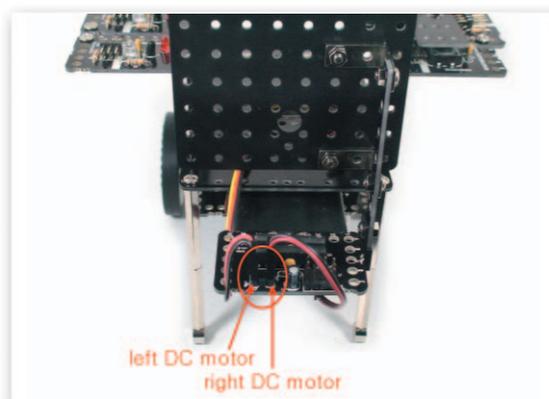
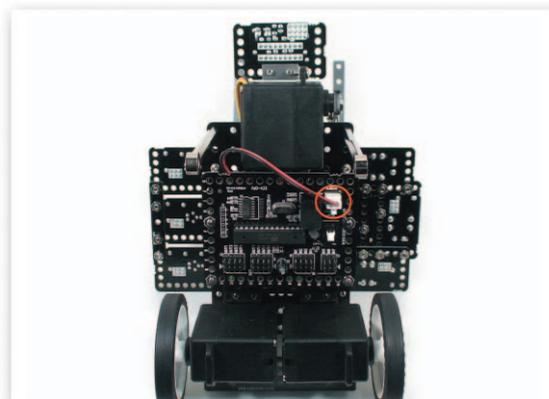
13 Put the Small 5 Frames under the Infrared Sensor Board and fix with bolts and nuts.

16 Connect the 3 Pin Cable to OUT Port 1, 2, 3, 4 of the CPU Board and the DC Motor Drive Board 1, 2, 3, 4. Connect the Servo Motor cable to OUT Port of the CPU Board.



14 Put the Contact Sensor Board and the Infrared Sensor Board on the Support that is fixed to the Main Frame and fix with nuts.

17 Connect the 3 Pin Cable to IN Port 1, 2, 3, 4 of the CPU Board and the Contact Sensor Board.



15 Connect the Power cable of the Battery Case to the Power Connector of the CPU Board. Connect the DC Motor cable to the DC Motor Drive Board A, B.

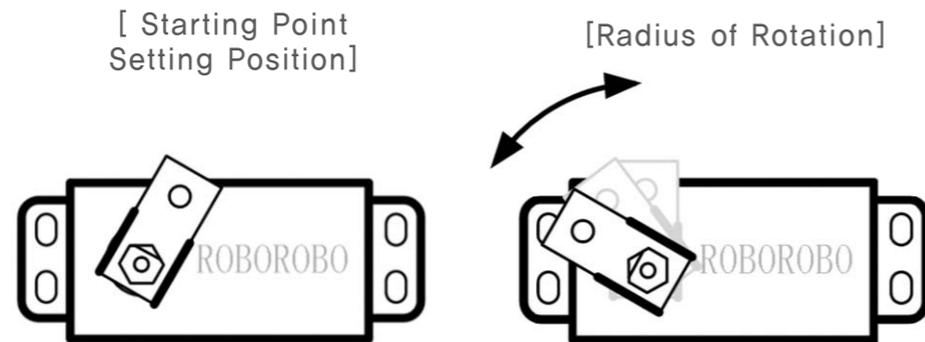
18 Connect the 3 Pin Cable to IN Port 5, 6, 7 of the CPU Board and the Infrared Sensor Board.

# Explain the Program

# WheelchairBot

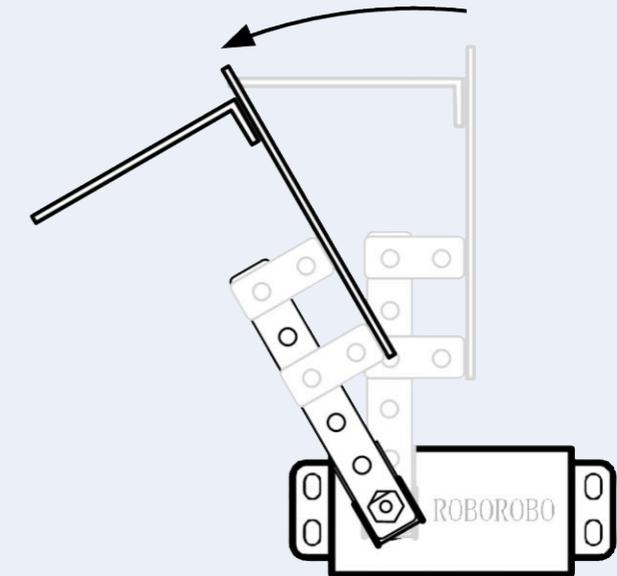
## Set the Servo Motor

- Main Function : Setting the starting point and the rotation position.
- Application : Set the zero point and then insert the Motor Guide on a position of setting the starting point and set the rotating position with the Servo Motor Chip.



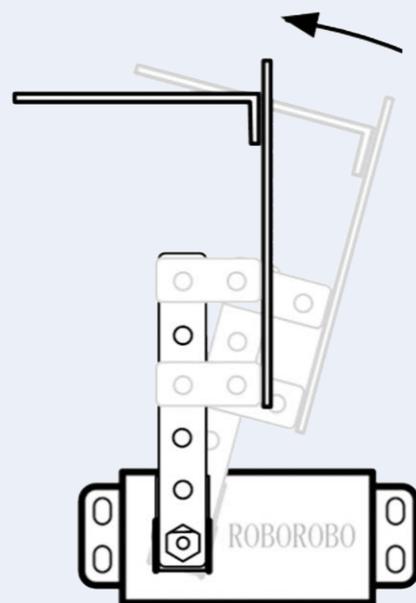
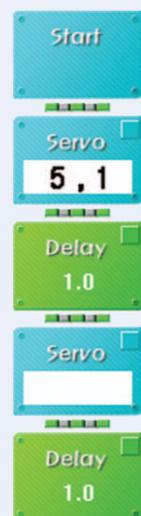
### Try This!

Set the Servo Motor Chip as the back of the wheelchair bends to lean comfortably.



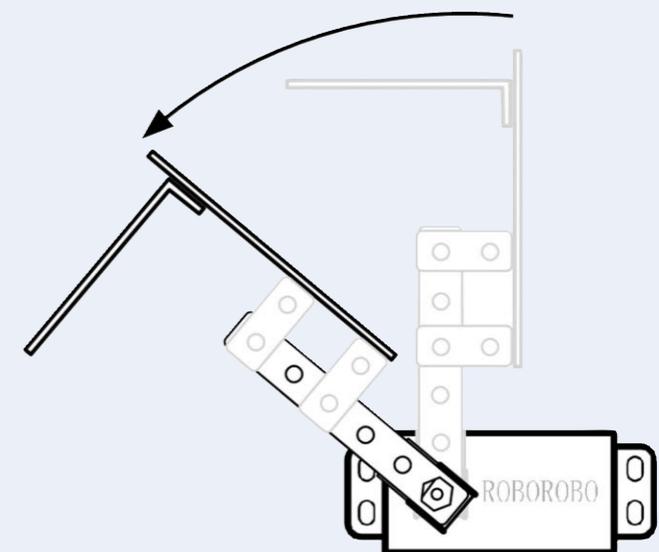
### Try This!

Set the Servo Motor Chip as the back of a wheelchair can stand.



### Try This!

Set the Servo Motor Chip as back of wheelchair bends little more to lie down comfortably.



# Shall we make it move?

# WheelchairBot

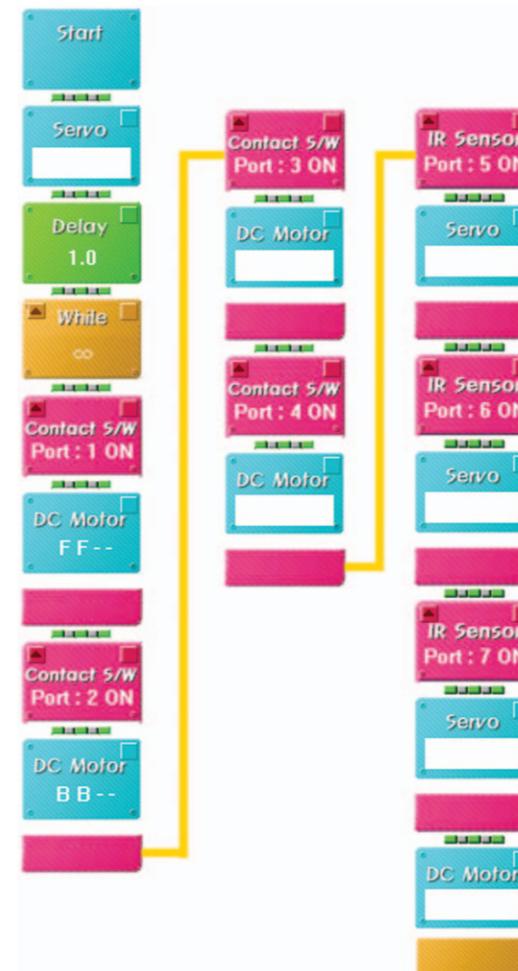
**1** Try to move forwards when pressing the Contact Sensor Board 1, move backwards with 2, turn left with 3 and turn right with 4.



**2** Make the back of a wheelchair lean to support when the Infrared Sensor Board 5 detects a hand, lean little more to lie down when 6 detects a hand and stands when 7 detects a hand.



**3** Use joystick (Contact Sensor Board) to move forwards and backwards, turn left and right and make the back of a wheelchair lean or stand when the Infrared Sensor Board detects a hand.



**4** Let's think about what functions should be added for the aged and disabled' s convenience as controlling WheelchairBot using the joystick and the Infrared Sensor Board.

# What did you learn?

# Work of the Day

1. What kind of robot will I make for disabled and aged people?

Robot for Aged People:

Robot for The disabled:



Teacher's Evaluation and Task	Teacher's Confirmation

Attach your own BattleBot!

**BattleBot** is a self-created robot to play pushing out game. You can perform your abilities as practicing assembly methods and program chips that you have learned. Play pushing out game with friends By operating the created robot using the Wireless Remote control.

- ▶ Battle : fight, warfare, armed conflict
- ▶ Creative : inventing and making of new kinds of things

• • • BattleBot • • •



(Logo of BattleBot)

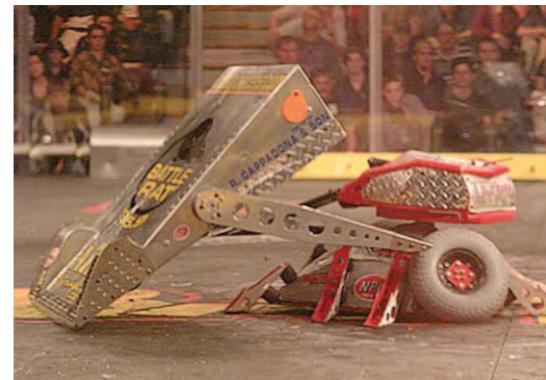
More than 1000 robot teams in America and all over the Europe apply for preliminary match of Battle Robot League and the League is run as form of tournament as a winner of 2 robots' fight for 3 minutes goes up to next round. It has 4 robot weights which are Lightweight class, Middleweight class, Heavyweight class and Super heavy weight class.



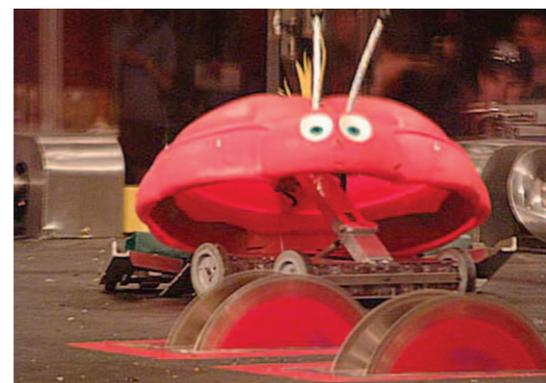
The Match of Super-heavyweight class between Disector(left) and World peace. Disector is a robot that remained within 3rd since its debut. With its strong chin and chopping hammers on both sides it flips opponent's robot.



The Match of Heavyweight class between Nightmare(left) and Slamjob. Nightmare is the most aggressive Battlebot and always ranked on top. It is trying to break Slamjob with its spinning disk.



The Match of Heavyweight class between TazBot(left) and Battle rat. Hammer that looks like axe, the main weapon of TazBot, can move parallel and perpendicularly and has specialty of flipping opponents. TazBot is able to automatically flip over itself during the match.



Dentamoosh, which is selected as 'the most interesting robot' with unique design and clever attacking method. The tactic of this cute robot is to cover an opponent first to attack with saw.

# 03

ADVANCED GRADE COURSE

## Advanced Course

Process to grow creativity and teamwork as making advanced robot in teams using various preparations.

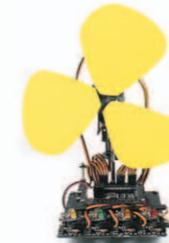
Introduces and induces creative and cooperative robot production using High-speed DC Motor and various Sensor Boards.

SoccerBot



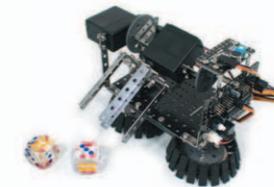
Can play Robot soccer game using High-speed Motor and learn method to control small and fast robot

FanBot



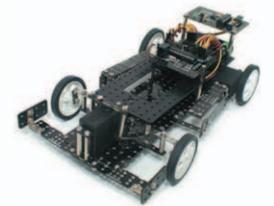
Understanding theory of propeller that moves air crafts or ships by Fan Robot

DiceBot



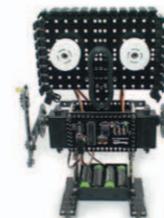
Understanding theory of Sound Sensor through interesting game with robot that rolls dice with a clap

FormulaBot



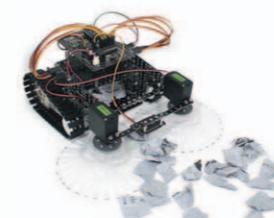
Studying actual mechanism of steering system of vehicle by producing steering system using Servo Motor

FlagBot



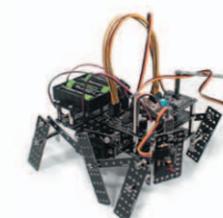
Process of moving robot arms with robot that can play blue-white flag game

SweepBot



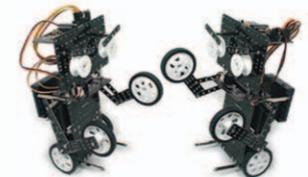
Studying Theory of Cleaning Robot that automatically controls rotating speed of DC Motor by amount and size of garbage

BugBot



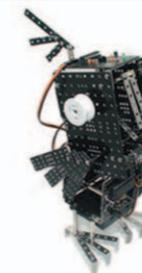
Studying mechanism of moving 6 legs as using 2 DC Motors and Link structures

BoxingBot



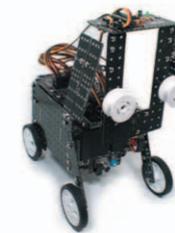
Studying theory of link structure of robot with movements of bending joints of arm using Servo Motor

ParrotBot



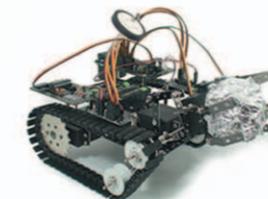
Studying theory of automatic answering function by assembling talking robot using Sound Sensor and Voice Board

DogBot



Studying various movements and creative program as moving over doorsill by drive of Servo Motor

SpaceBot



Studying function of Space Exploration Satellite as understanding mechanism of grab, pull up and carrying object

BattleBot

Create

Gaining confidence as make creative robot freely and present your own work through presentation

Unit of component, shape and size can be changed without notice for improvement however no problem in usage.

# MEMO

