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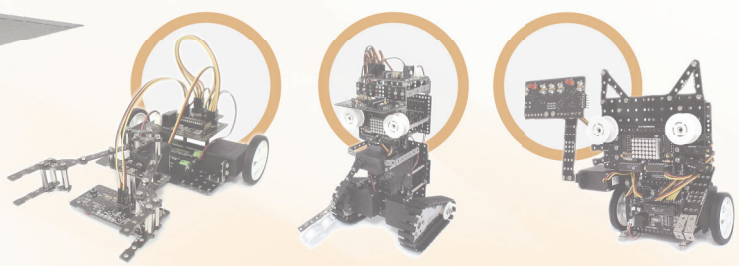
ROBOROBO Intelligent Robot School

Step 05



The world for prospective scientists, who will lead the future

Future Robot World

From seven years of age upward

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

Safety 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 into 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. 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.
8. Please assemble and operate with a guardian or a teacher.
9. Our kit includes small parts so children under three years of age are not admitted to use.

Intelligent Robot School 05

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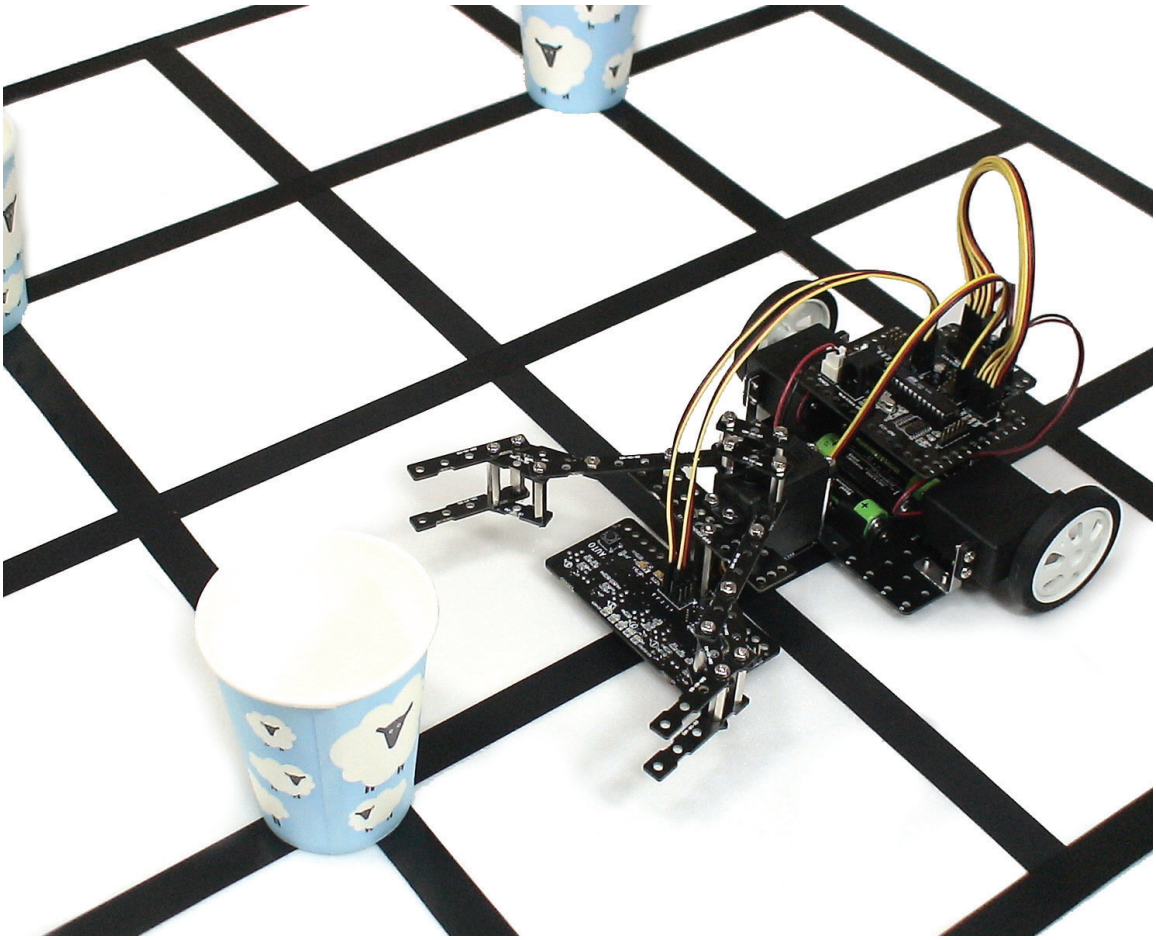
Today's Goal



MissionBot is a robot that drives along the line by the automatic IR sensor and moves the obstacles with the gripper. Let's find out Function Chip that simplifies infinitive line trace program or long and complex program. And let's complete the mission to remove the bomb!

▶ Mission : assignment, commission, expedition
▶ Function : purpose, task, role

• • • Function • • •

〈Key Board〉

Have you heard of a word ' Function ' ? Function has meaning of purpose, task and role that is usually used in mathematics or computer.

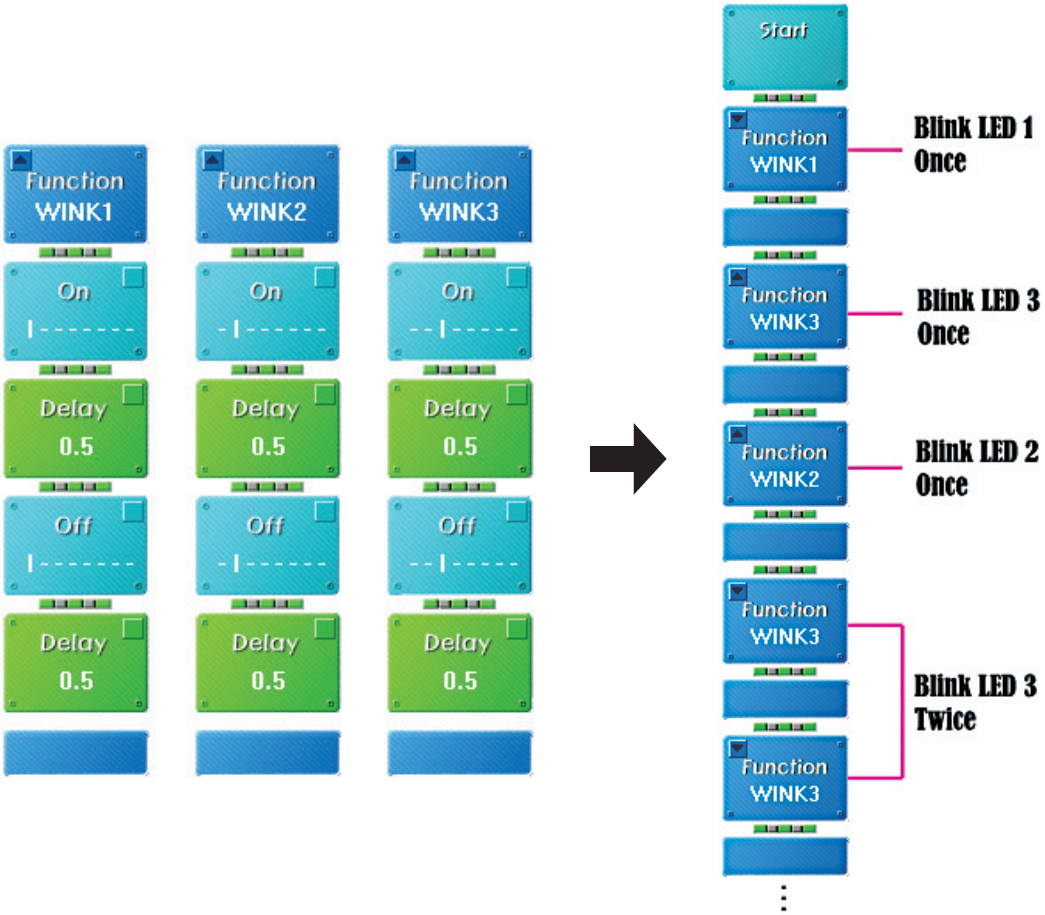
Also keys like Esc, F1, F2, F3… on keyboard, are called function keys and each key already has a program so it performs the order quickly by one key by memorizing frequently used order or special function.

In case of our Rogic program, it will be better to use a chip like a function with an already-inputted program? Then, let's have a look at an example.

Blink the LED no.1 once → Blink the LED no.3 once → Blink the LED no.2 once →Blink the LED no.3 twice → .....

If you keep going like above, it will be very long program. But "Function Chip" can solve this problem very simply.

First, make the Function Chip with a name of ' WINK1~3 ' and insert the program of blinking LEDs like the picture below. It becomes the simple program at the right side which is same as long and complicated left program.

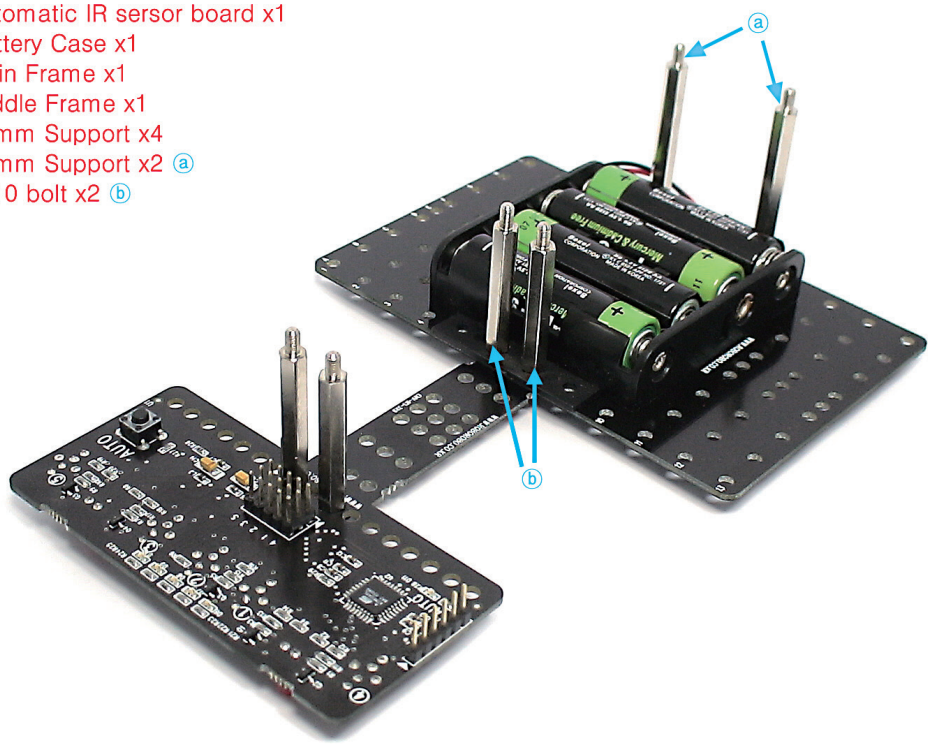


–Wink : To close and open one or both eyes quickly, To shine with little flashes of light; twinkle

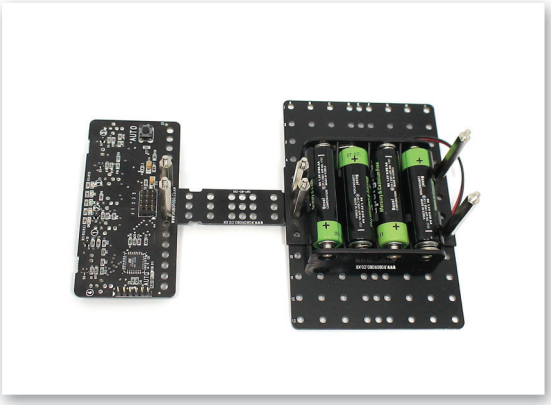
It is far simple and easy, isn't it? The most important function of this ' Function ' is calling the repetitive program easily. However, you have to be careful that if you change any content of the Function, not only the function but all same named function will be changed.

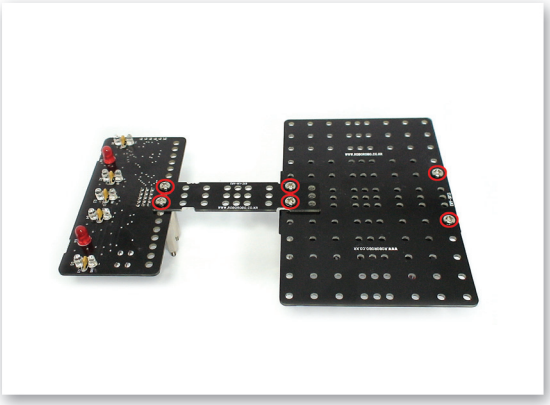
How to Assemble

Automatic IR sersor board x1
Battery Case x1
Main Frame x1
Middle Frame x1
30mm Support x4
40mm Support x2 ⓐ
3x10 bolt x2 ⓑ



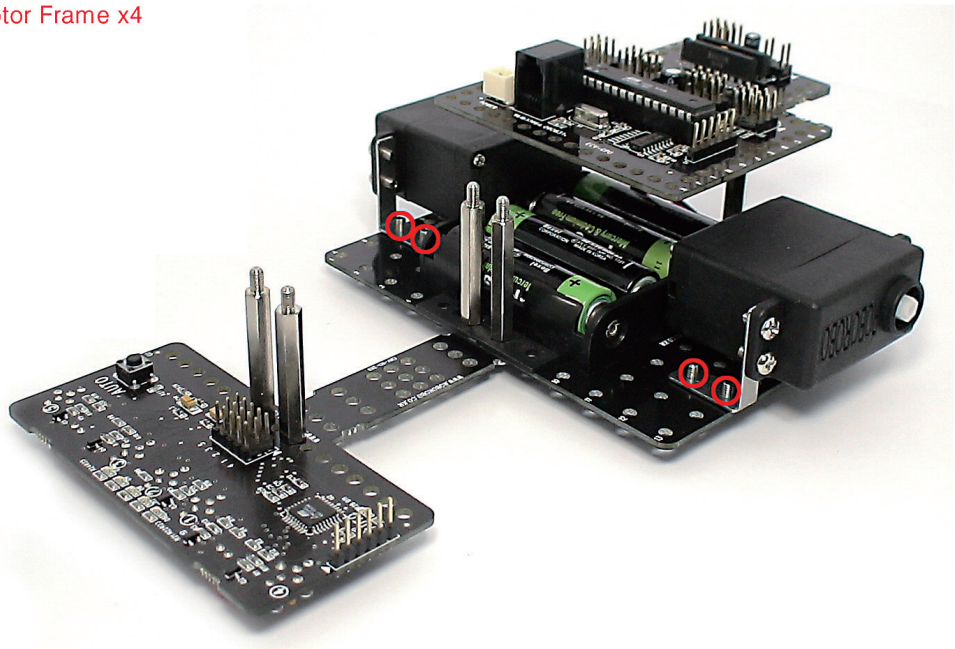
1 Fix the Battery Case on the Main Frame and then connect to the Automatic Infrared Sensor Board using the Middle Frame.



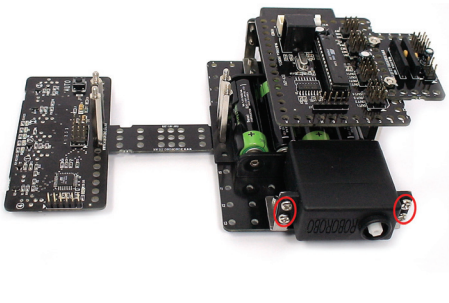


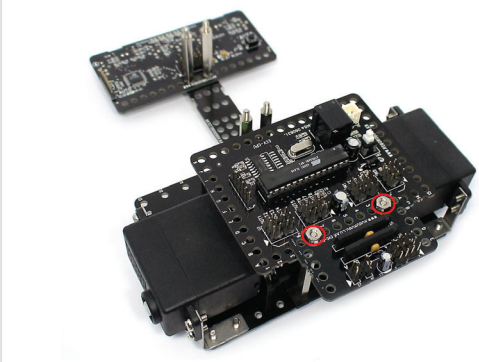
2 Check the assembling position of the Middle Frame carefully. Refer to the both pictures taken from different angle.

CPU Board x1
DC Motor Drive Board x1
DC Motor x2
Motor Frame x4



3 Fix the DC Motors to the Main Frame and then fix the CPU Board and DC Motor Drive Board on the Supports.

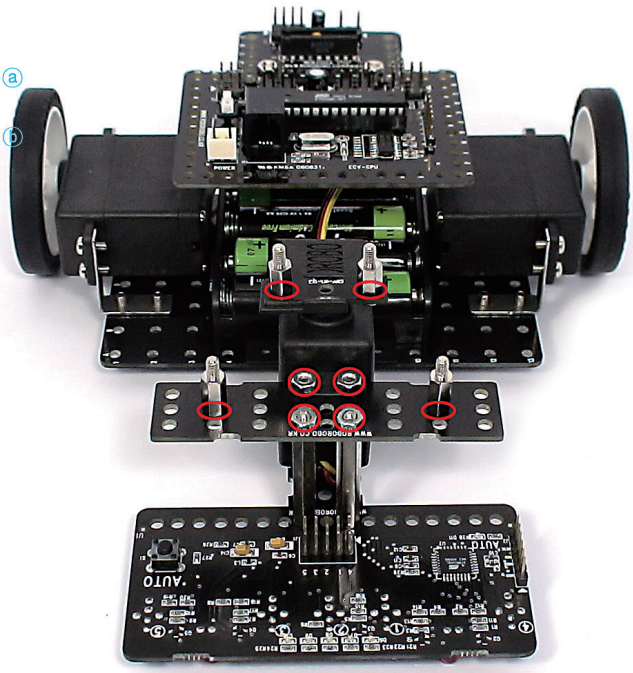




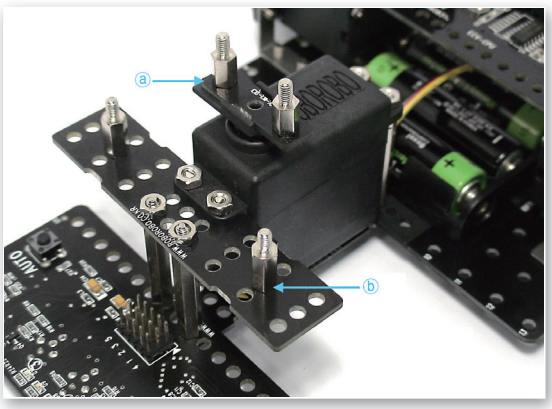
4 Refer to the both pictures taken from different angle.

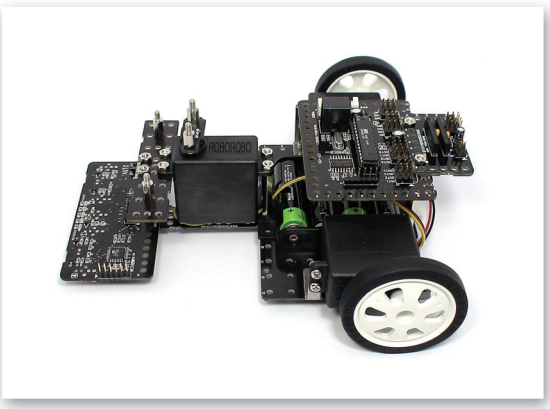
How to Assemble

Servo Motor x1
Motor Guide x1
Wheel x2
Middle Frame x1
3-holes Frame x1 ⓐ
7mm Support x2
10mm Support x2 ⓑ

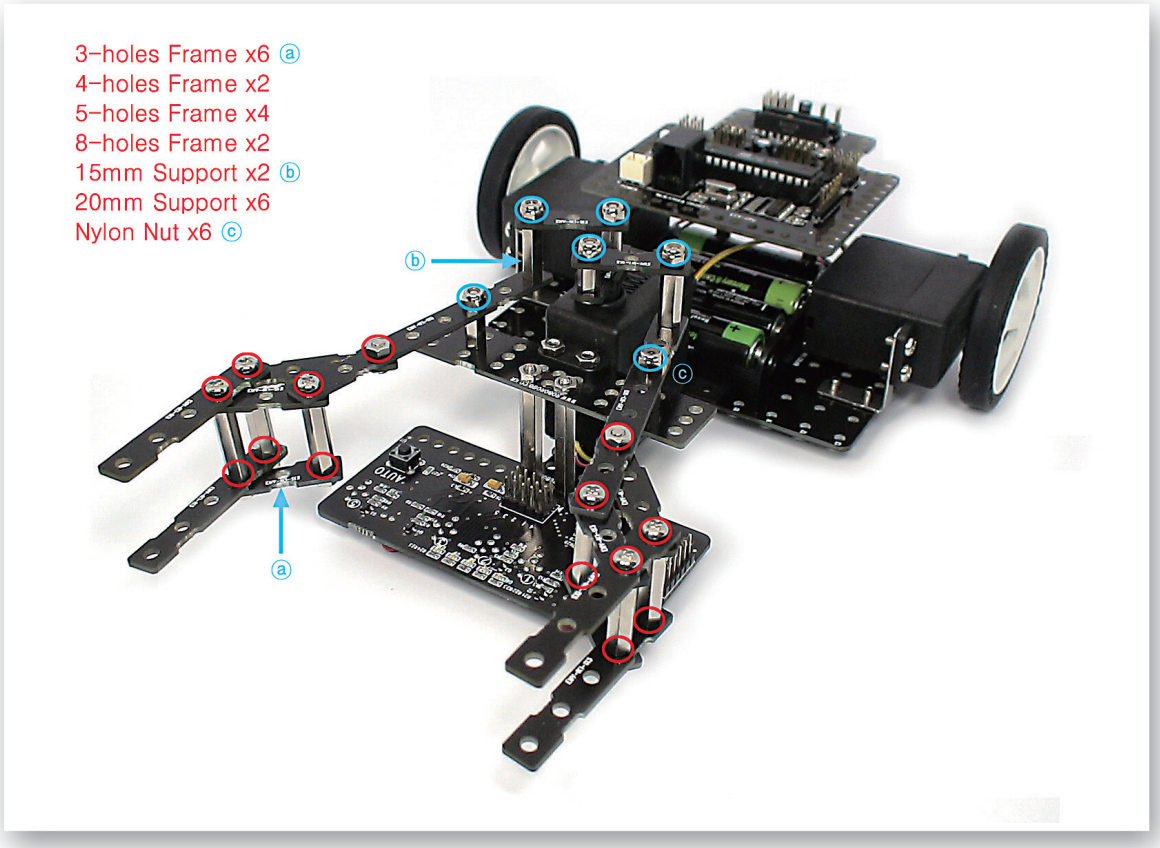


5 Fix the Middle Frame and Servo Motor to the Support and then insert the Motor Guide to the Servo Motor axle. Fix the 3-Holes Frame and 7mm Support to the Motor Guide and fix the 10mm Support to the Middle Frame.

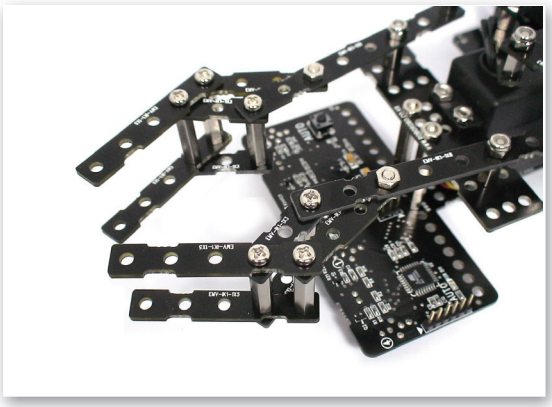


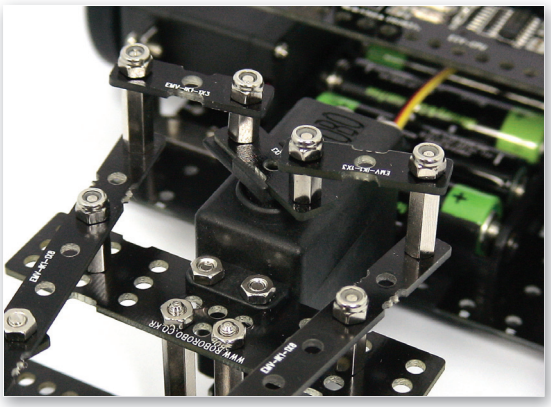


6 Refer to the both pictures taken from different angle.



7 Make the gripper by connecting various frames and supports to the Motor Guide.

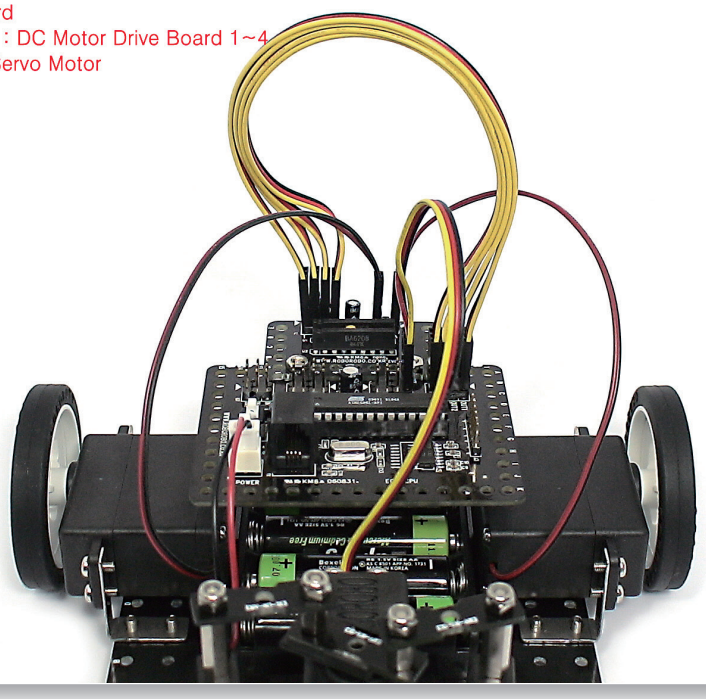




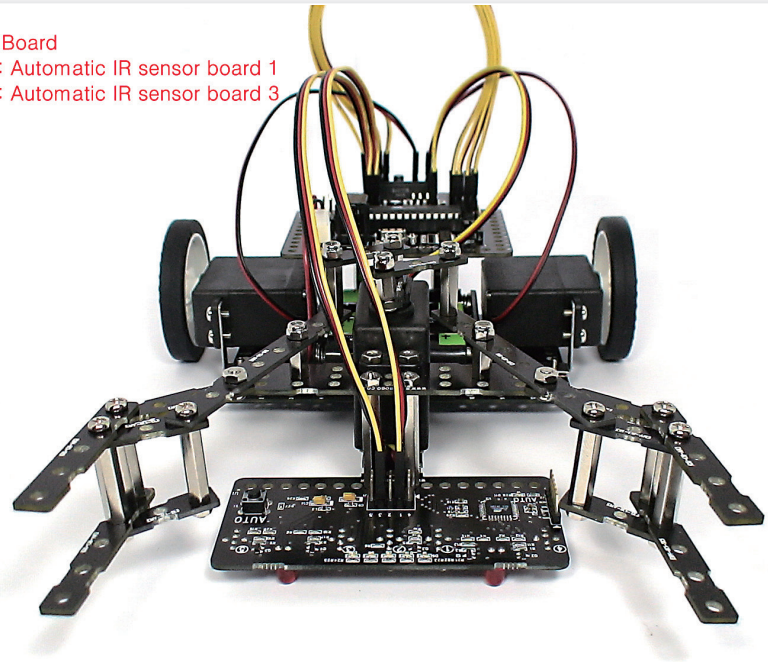
8 Refer to the both pictures taken from different angle.

How to Assemble

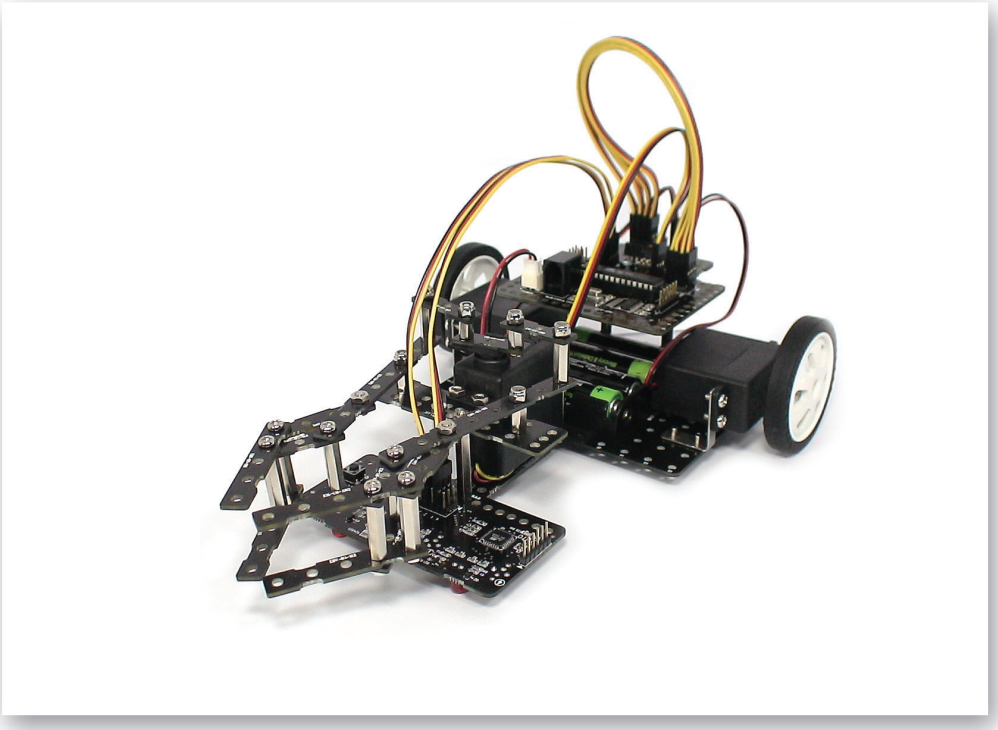
CPU Board
OUT 1~4 : DC Motor Drive Board 1~4
OUT 5 : Servo Motor

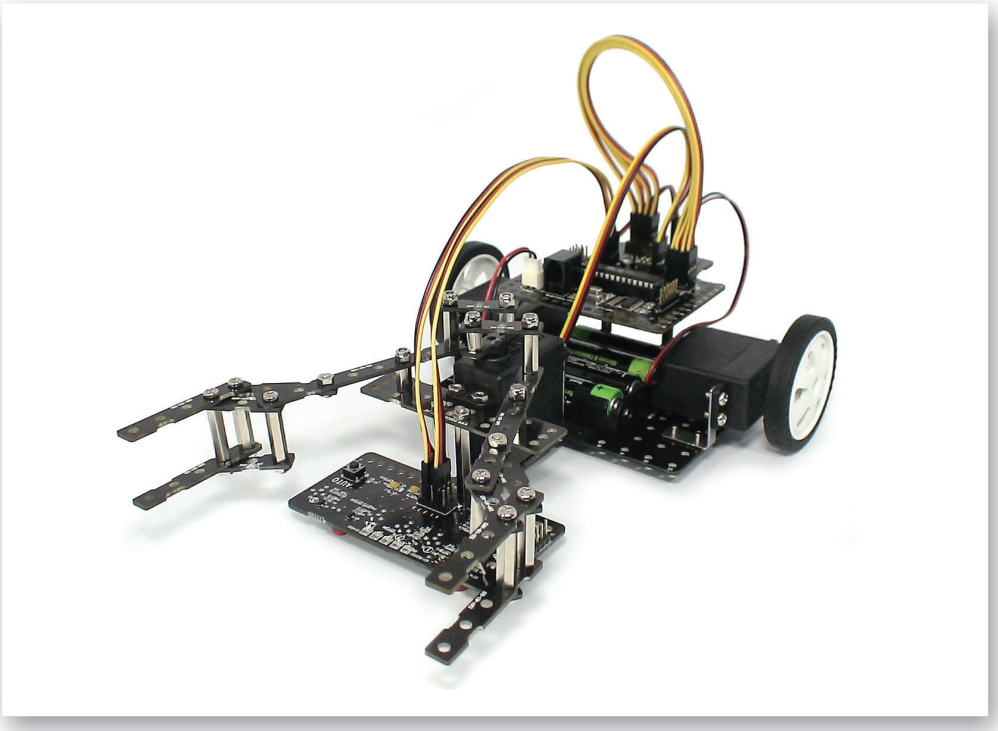


CPU Board
IN 1 : Automatic IR sensor board 1
IN 2 : Automatic IR sensor board 3

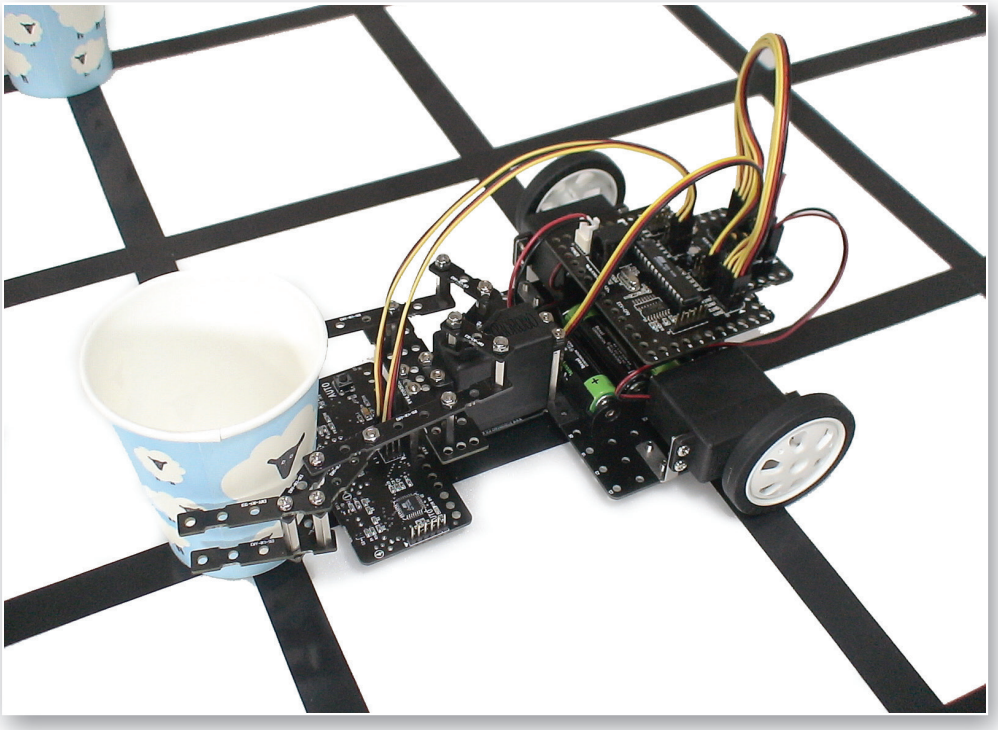


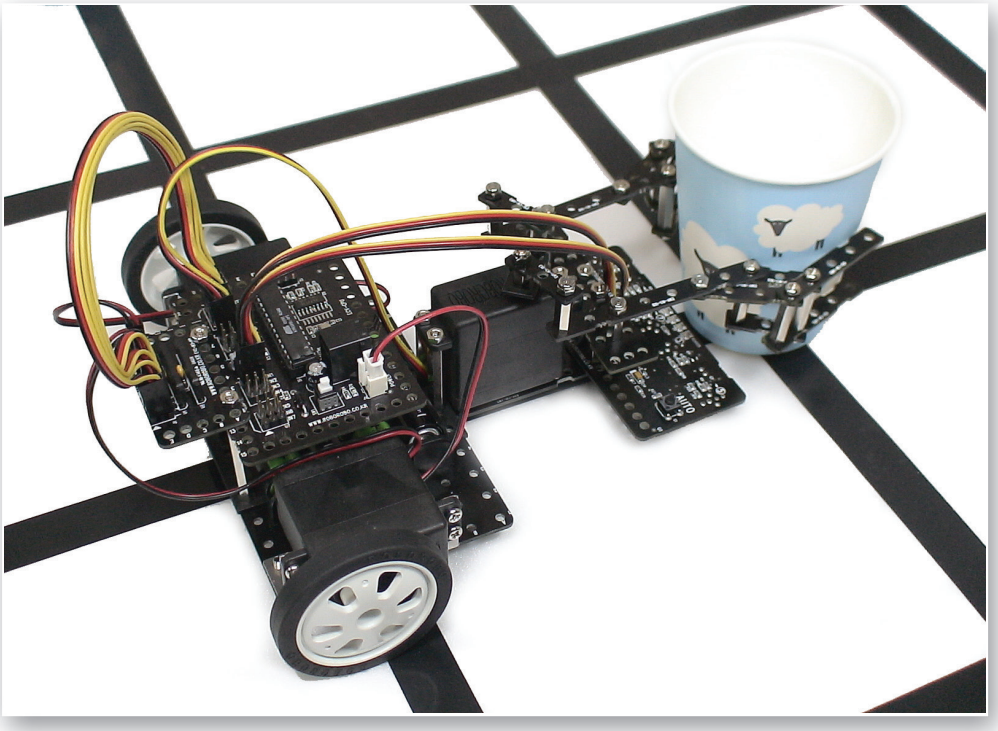
Completed MissionBot!



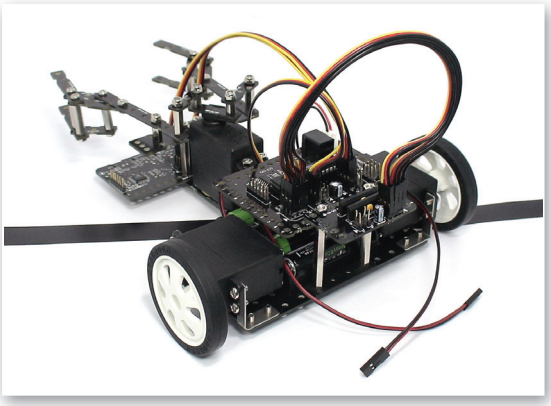


Let's Decorate!

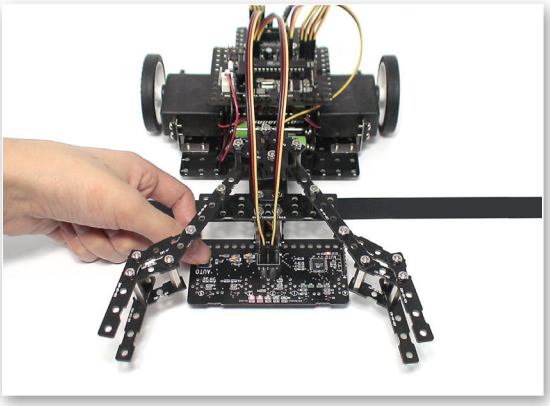




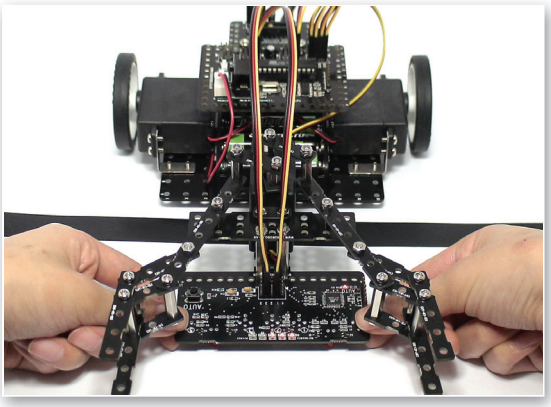
Sensor Tune-up!



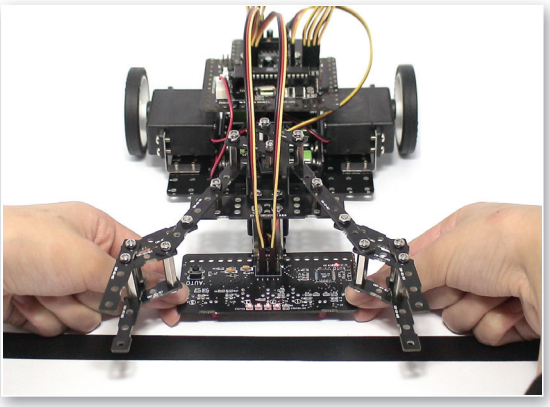
1 Pull out the Motor cable that is connected to the DC Motor Drive Board then turn on the power.



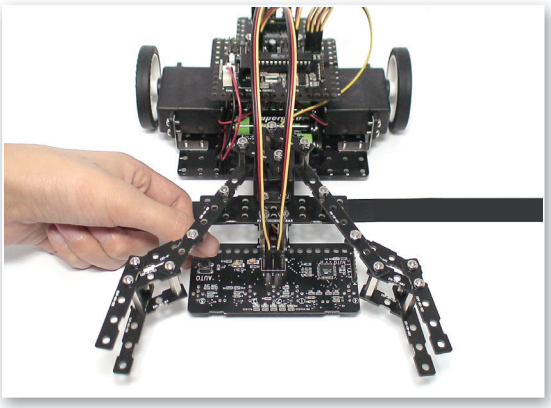
2 Press AUTO button of the Automatic Infrared Sensor Board. (Repeat the LED on and off in order.)



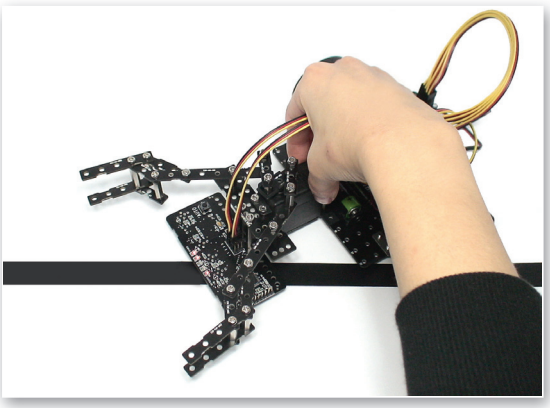
3 Make the Automatic Infrared Sensor Board to detect white. (Beware not to make it be off the ground.)



4 Make it detect black to follow the line. (Repeat step.3 and 4 actions two or three times)



5 Press AUTO button of the Automatic Infrared Sensor Board. (Stop LED blinking.)

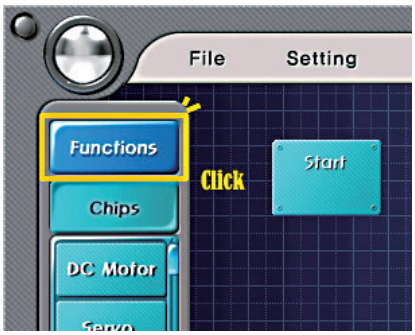


6 Check if it detects white and black right. (LED turns on if it detects white.)

Function Chip

- Main Function : It includes the long program in one chip or functions repeatedly.
- Application : Put the already-made chip into the required position.

[Example]



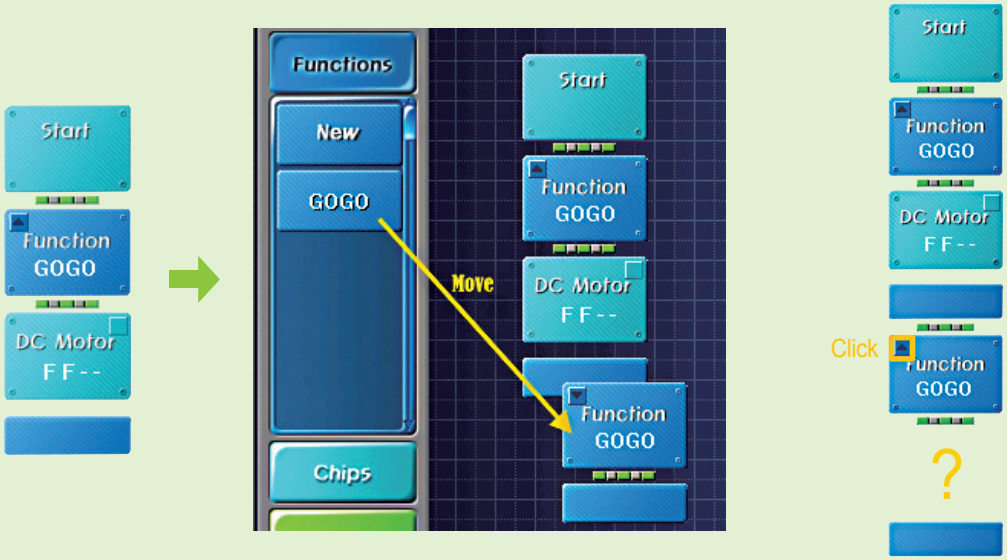
Practice!

Make the function chip arranged below.

Name	Does it work?		Reason that does not work.
WINK	O	X	
WINK2	O	X	
ROBOROBO	O	X	
12345678	O	X	
My name	O	X	
FF&BB	O	X	

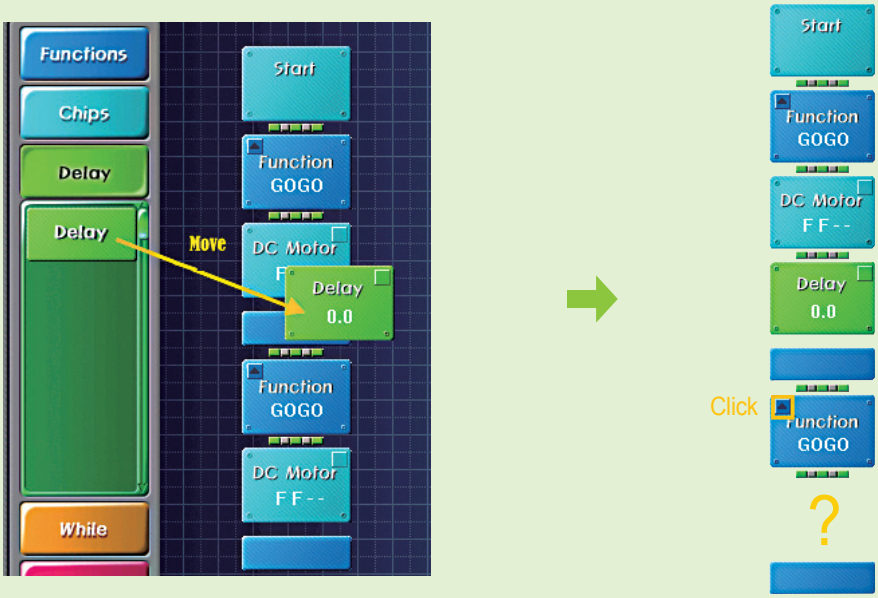
Practice!

Make the GOGO Function Chip and put the Motor Chip in it and then add another GOGO Function Chip. What is there in the 2nd GOGO Function Chip?



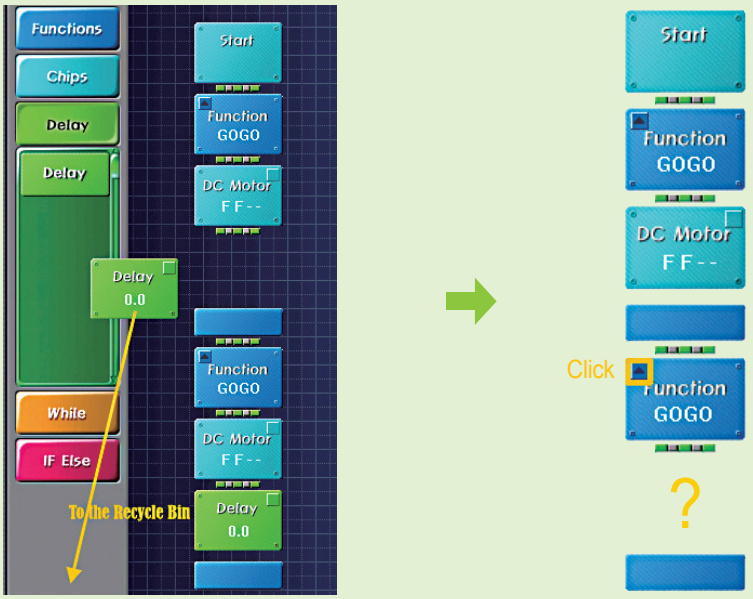
Practice!

If you put the Delay Chip into the GOGO Function Chip, what will happen in the 2nd GOGO Function Chip?



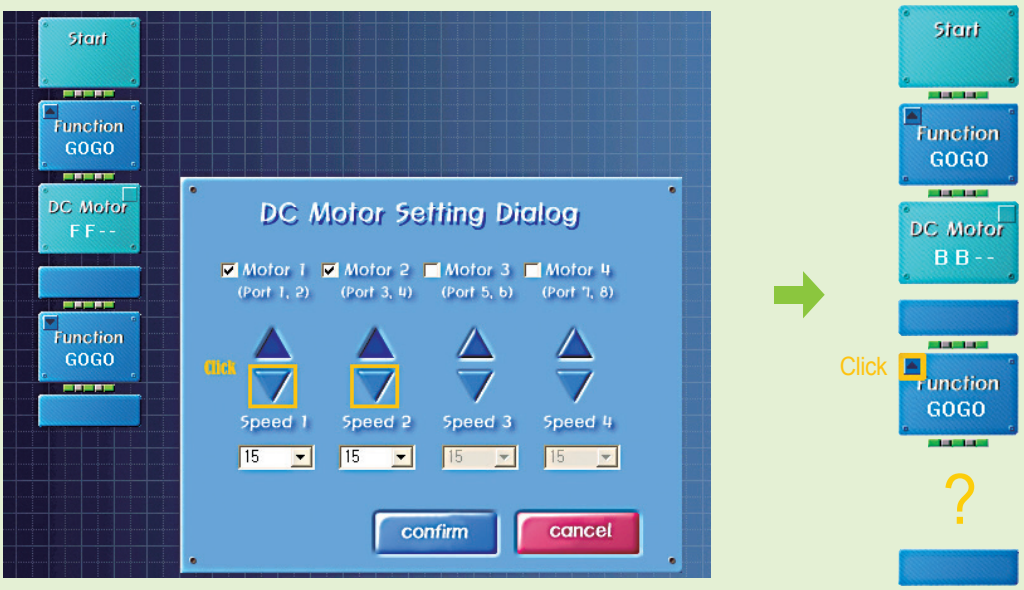
Practice!

If you delete the Delay Chip in the GOGO Function Chip, what will happen in the 2nd GOGO Function Chip?



Practice!

If you change the setting of the Delay Chip in the GOGO Function Chip, what will happen in the 2nd GOGO Function Chip?



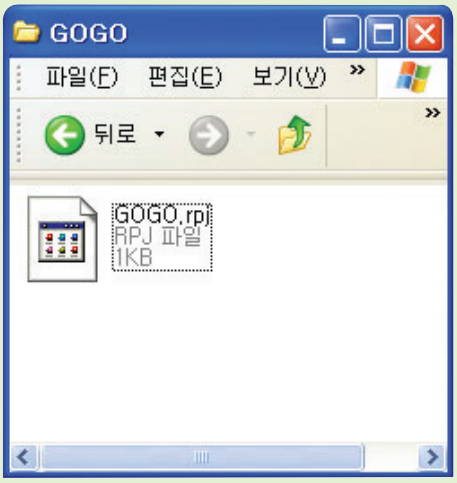
Function Chip Deletion

- Main Function : You can delete the function chip completely from the Rogic program.
- Application : Find the saving path and delete the program.

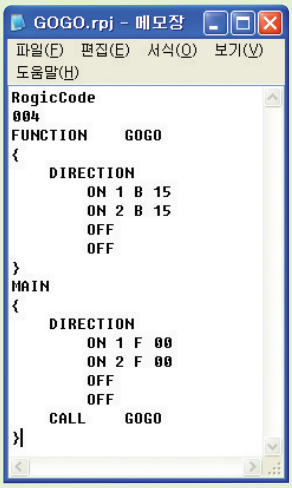
Practice!

Delete the GOGO Function Chip.

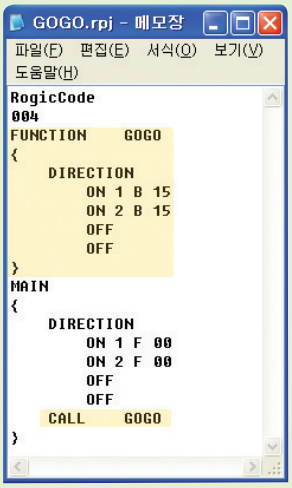
1 Save the program.
(File Name : GOGO)



2 Find the stored folder.



3 Open GOGO.rpj from Notepad.



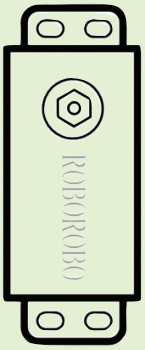
4 Delete the colored area and save again.

Set the Starting Point of the Servo Motor

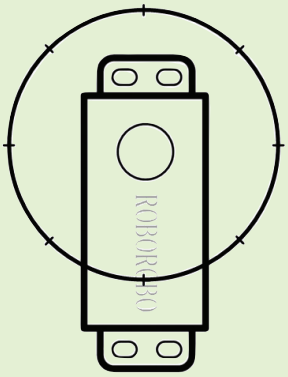
- Main Function : It sets the starting point and rotation radius of the Servo Motor.
- Application : Set the zero point and then insert to the Motor Guide to Starting Point set the position and set the rotating position with Servo Motor Chip.

Practice!

Draw the triangular groove and radius of rotation of the Motor Guide.



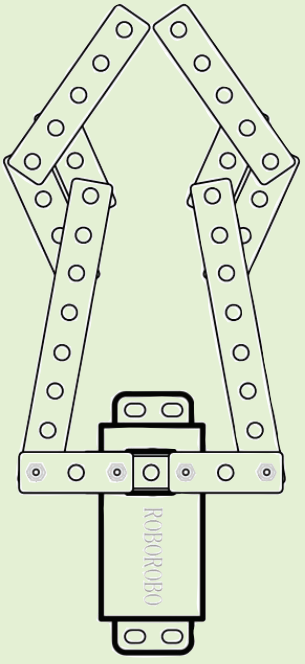
[Starting Point Set up Position]



[Radius of Rotation]

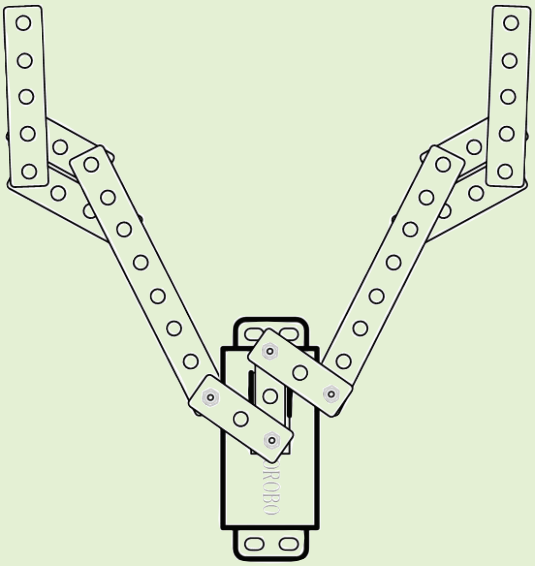
Practice!

Close the robot's gripper.



Practice!

Open the gripper.



Practice!

Make the Function Chip to close the gripper and another Function Chip to make it open.

Function

Function

Shall we make it move?

1 Make the robot drive along the black line. And if it meets the crossroad, make it stop. Then, make the FFGO Function Chip to get out of ' WHILE '.

2 Make it pass three crossings by the FFGO Function Chip.

Can it pass? What is the reason?

.....

.....

.....

3 Modify the FFGO Function Chip to make it stop and get out of 'WHILE' if it detects interception while going forward for 0.3 seconds.

4 Make it pass three crossings by the FFGO Function Chip.

Can it pass? What is the reason?

.....

.....

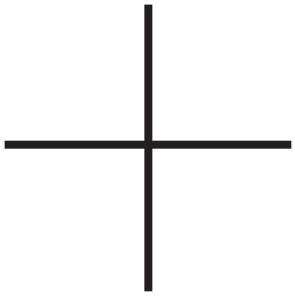
.....

Shall we make it move?

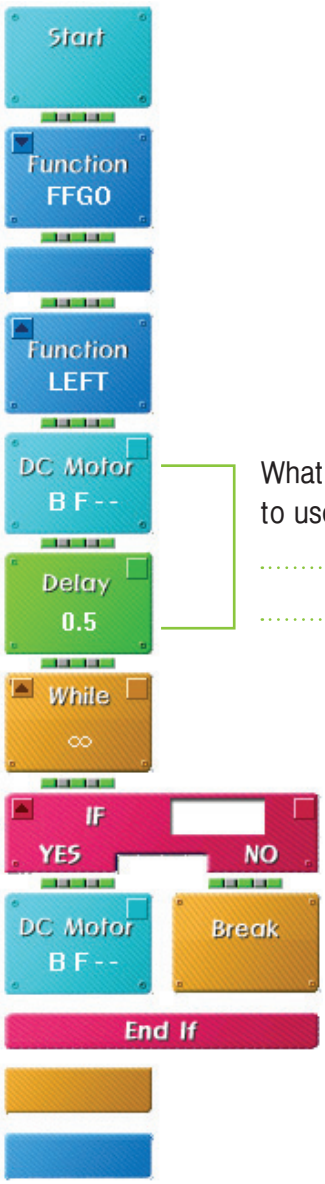
5 Make the LEFT Function Chip to make a 90° left turn.

6 Pass the crossroad by using the FFGO Function Chip and then turn left by the LEFT Function Chip.

Does it turn left as you wanted? Draw the robot on the position where the wheel touches to turn.



7 Change the LEFT Chip to turn left by detecting the line through the Infrared Sensor.



What is the purpose to use?

.....

.....

Tell me about what is different from the way to rotate No. 5.

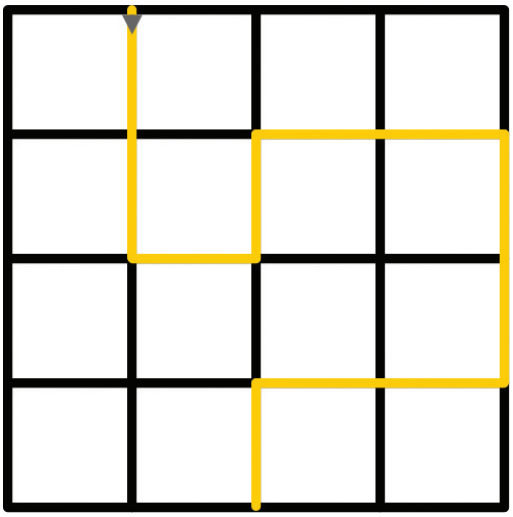
.....

.....

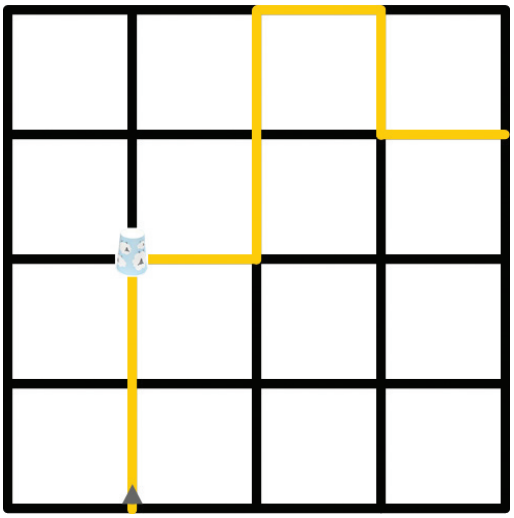
8 Make the Function Chip to turn right by detecting the line with the Infrared Sensor.

Shall we make it move?

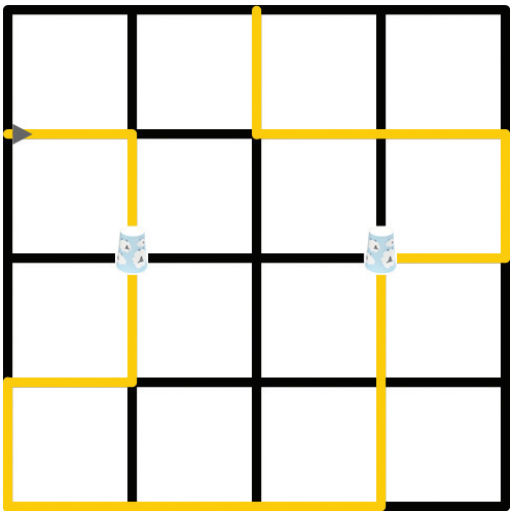
9 Pass the below route by using the Function Chip that you have made until now.



10 Pass the route below. (But, the paper cup should be pushed outside by using the Servo Motor.)



11 Pass the route below. (But, the paper cup should be pushed outside by using the Servo Motor.)



12 Combine all of the programs to play the game.

Let's Play Game!

Mission : Dispose of bombs!!

1 Preparation

- Paper cups for bombs

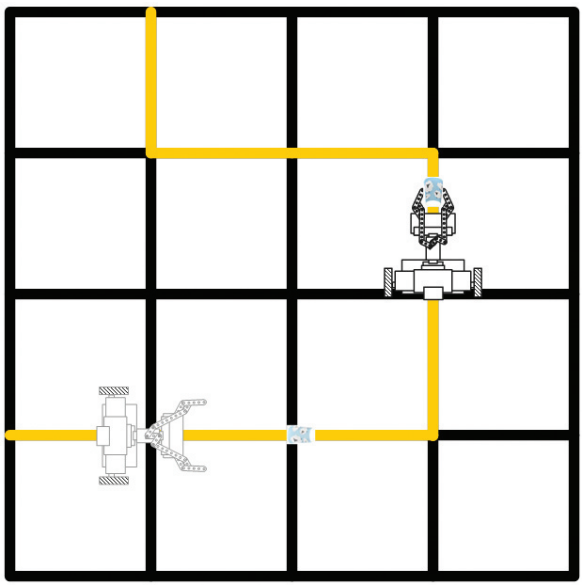
2 How to play

- Robot should find the bomb along the black lined maze in double-quick time and dispose of it.

3 Game rule

- Robot should move the bomb (paper cup) to the point of arrival by the gripper not by pushing.
- The Bomb must be set by the referee or staff.
- The Robot cannot drive off the black line during the game.
- The Robot should stop for more than three seconds at the point of arrival.

4 Game example



1 Preparation

- Paper cups for bombs

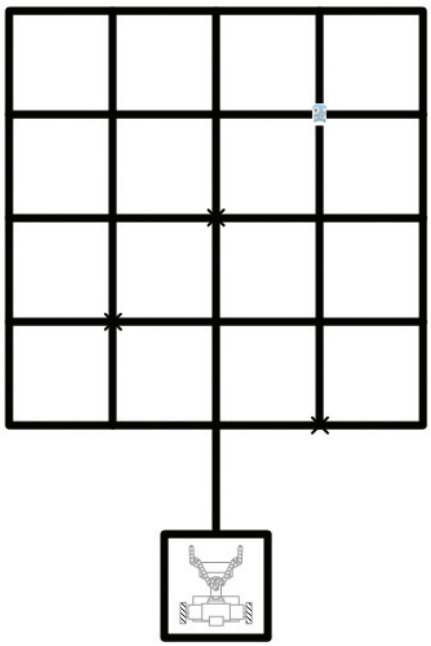
2 How to play

- The robot should move along the black lined maze and remove the bombs out of the maze as soon as possible and then come back to the starting point again.

3 Game rule

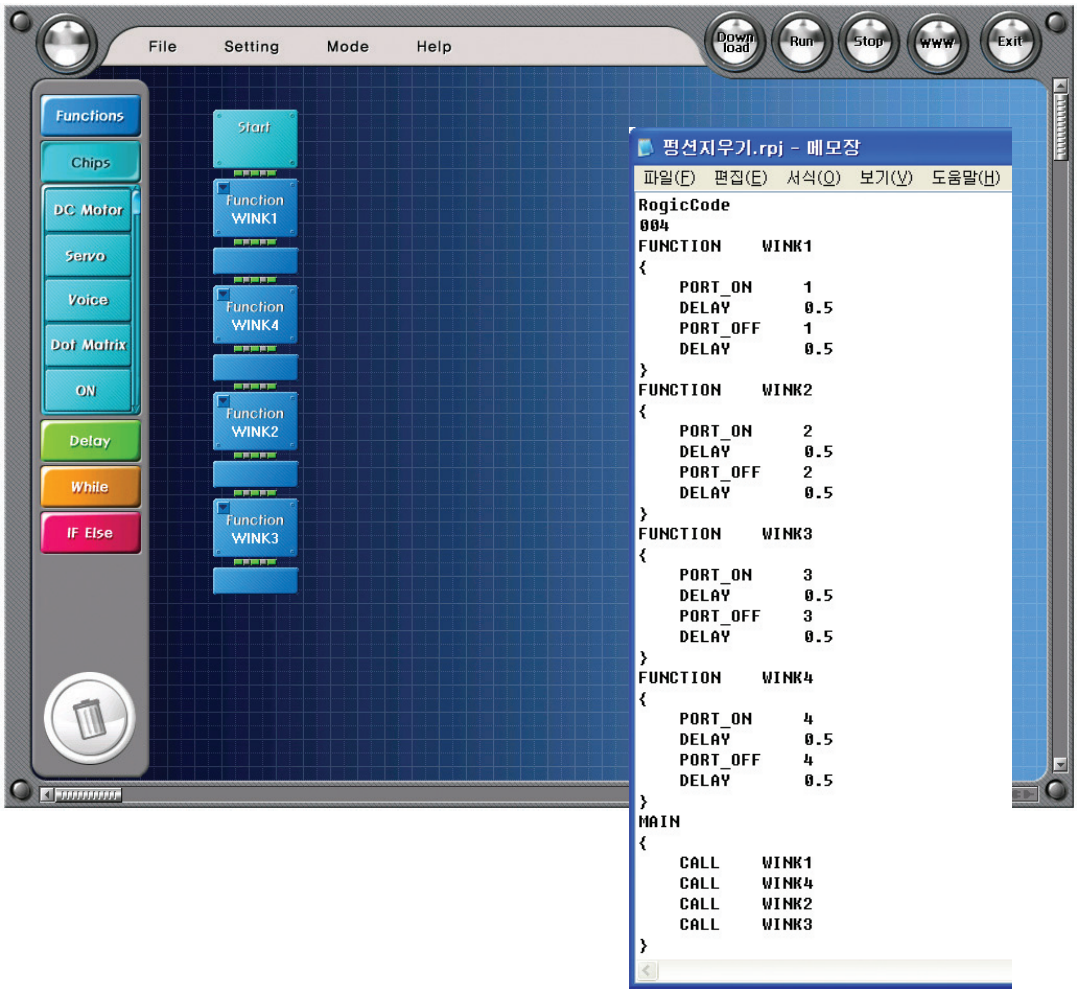
- Robot should move the bomb (paper cup) to the point of arrival by the gripper not by pushing.
- The Bomb must be set by the referee or staff.
- The Robot cannot drive off the black line during the game.
- The Robot should stop for more than three seconds at the point of arrival.
- The Robot cannot pass the 'x' signed on crossings.

4 Game example

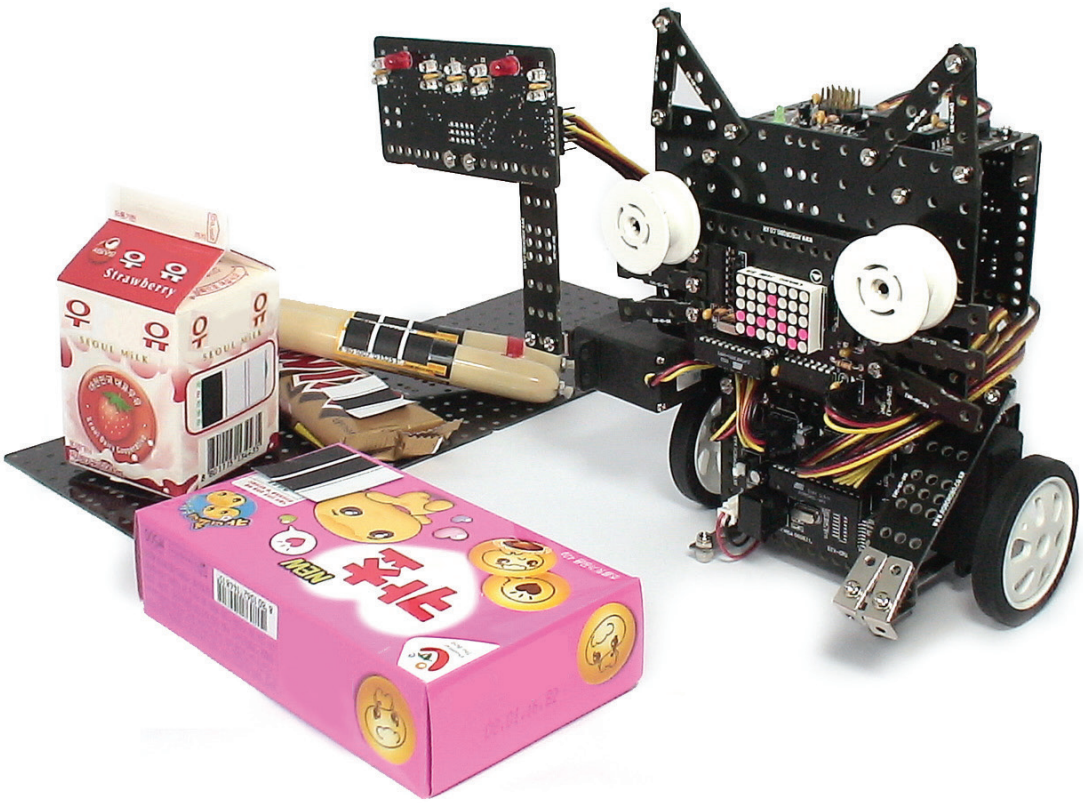


What did you learn?

1. The Picture below shows the program composed of the Function Chip named " WINK 1~4 ". What part of the Note Pad should be removed, to delete the " WINK 4 " Function Chip?



Homework	Teacher 's Check



BarcodeBot is a robot that uses the Automatic Infrared Sensor Board to read barcodes and then show through the Dot Matrix Board. Let's find out the principle to change the barcode into information in the supermarket. Then, build the BarcodeBot that can work instead of clerks in the mall!

▶ Barcode : an arrangement of texts or numbers and parallel lines in black and white
▶ Dot matrix : an arrangement of LED in matrix
▶ Scanner : a piece of computer equipment that you use for copying a picture or document onto a computer

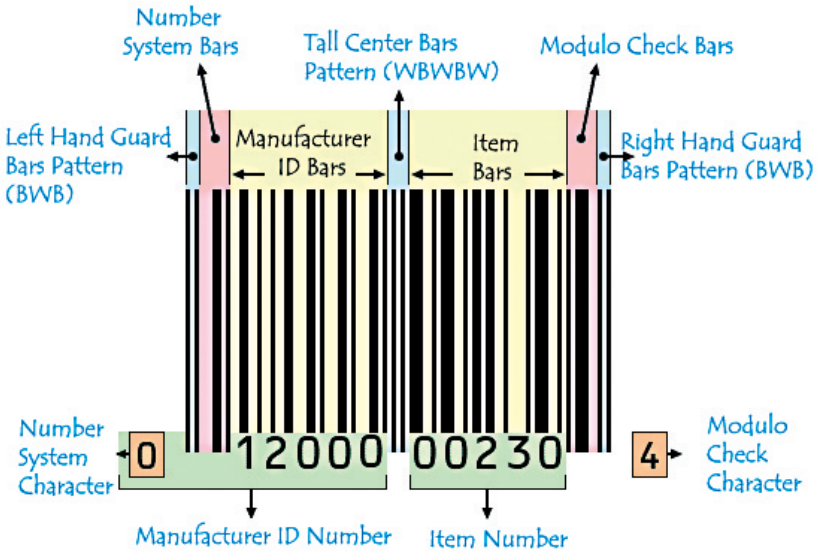
Barcode

〈A pack of milk with barcode〉

Have you ever seen a series of vertical bars of varying widths on the product like the picture above?

It is a bar code and it means literally "Bar like Code" . When you pay for grocery at the mall, you can see a clerk puts some device to the product. It is a laser scanner. If the laser scanner reads the barcodes and makes a 'beep' sound, it shows a name and price of the product and shows total amount in a very short time. It is because when you scan the barcode its data is sent to the computer as if it had been typed on the keyboard.

The scanner is invented for benefit of the employees, because it is troublesome to input characters or numbers marked on the product one by one in the computer.
It is a device that optically scans images, printed text, handwriting, or an object.



〈Decoding Bar code〉

http://www.punklist.com/~blake/science/science.html

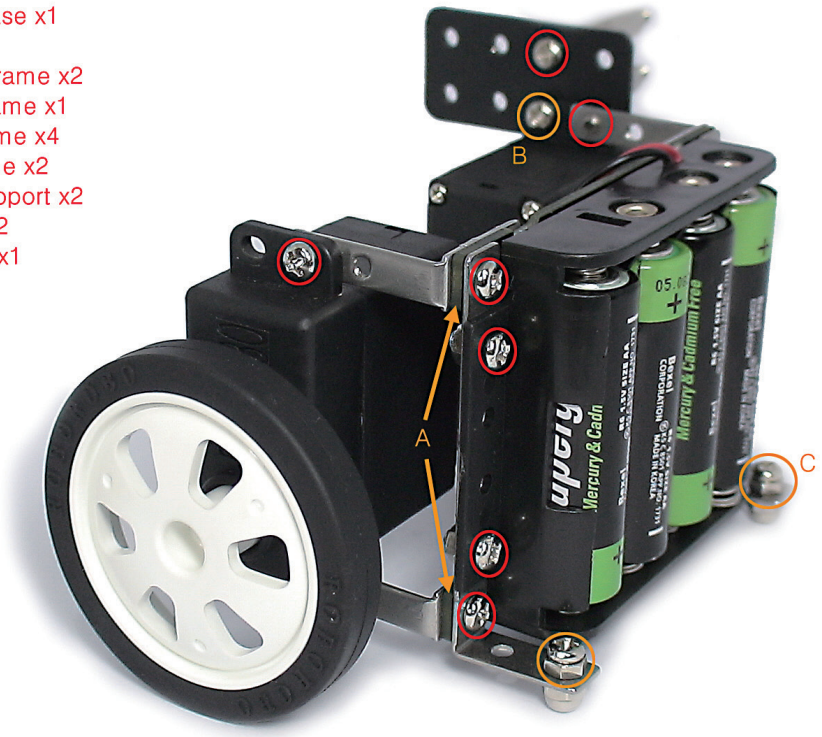
The bar code consists of white and black bars. Data retrieval is achieved when bar code scanners shine a light at the bar code, capture the reflected light and replace the black and white bars with binary(0,1) digital signals.

If so, what information is there in the bar code? Barcode has regular pattern and codes including country code, manufacturer code, item code, check code and so on. It has so much information compared to its size, doesn't it?

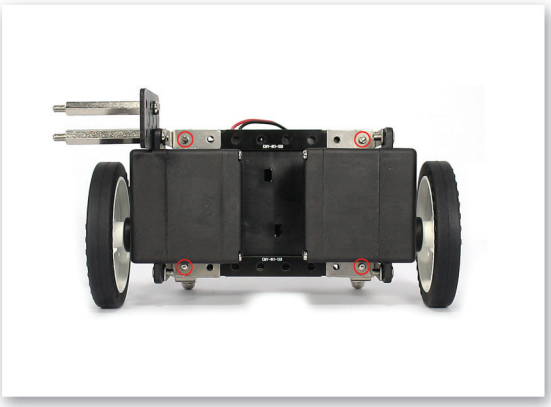
The bar code has already been applied in various ways such as the malls, department stores etc. Let's think about other applications. And let's also build the BarcodeBot by using the Automatic Infrared Sensor Board.

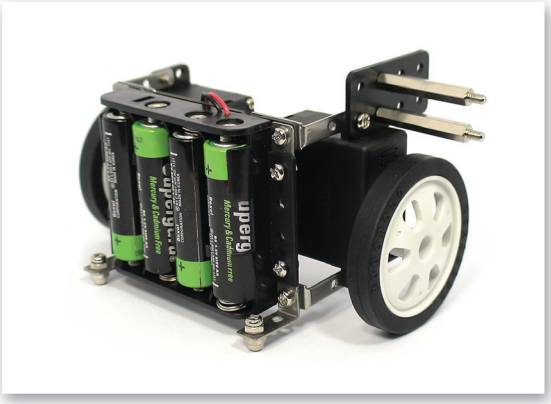
How to Assemble

DC Motor x2
Battery Case x1
Wheel x2
8-holes Frame x2
Option Frame x1
Motor Frame x4
L2x6 Frame x2
30mm Support x2
Cap Nut x2
3x10 Bolt x1



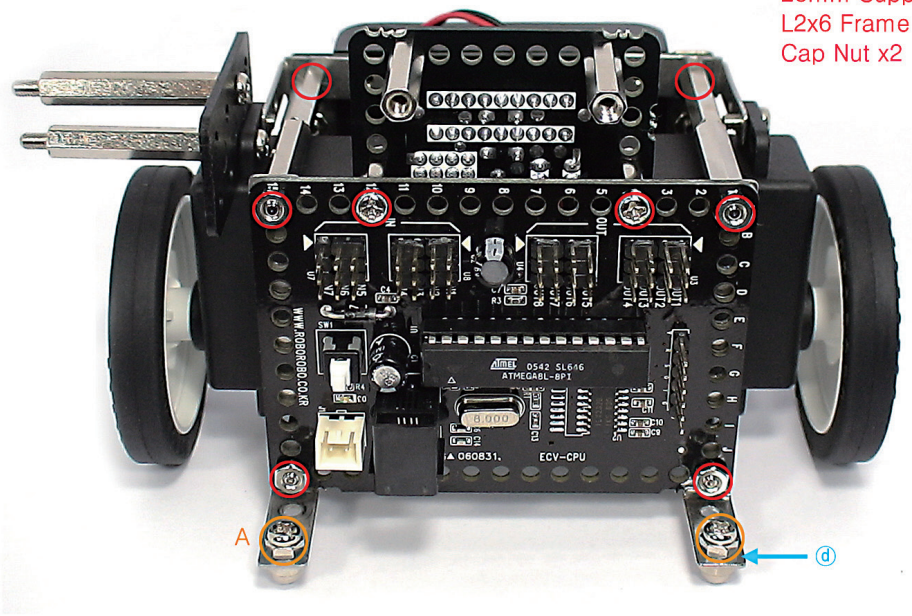
1 Connect the DC Motor and Option Frame to the Battery Case and then insert the Wheels.
A) Check the position of the 8-Holes Frames.
B) Insert the 3x10 Bolts with a screw driver.
C) Insert the Nut to Bolt ahead and then assemble with the Cap Nut at the bottom.



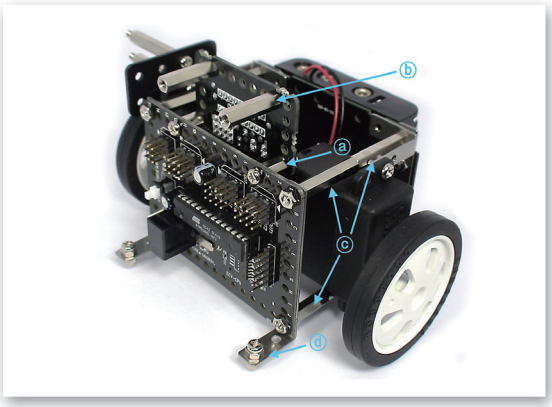


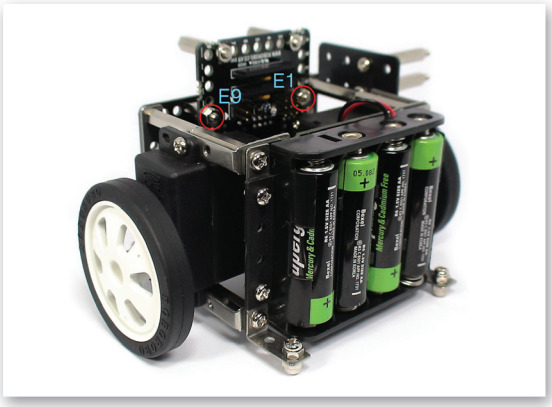
2 Refer to above two pictures taken from different angle.

CPU Board x1
DC Motor Drive Board x1
10mm Support x2 ⓐ
20mm Support x2 ⓑ
25mm Support x8 ⓒ
L2x6 Frame x2 ⓓ
Cap Nut x2



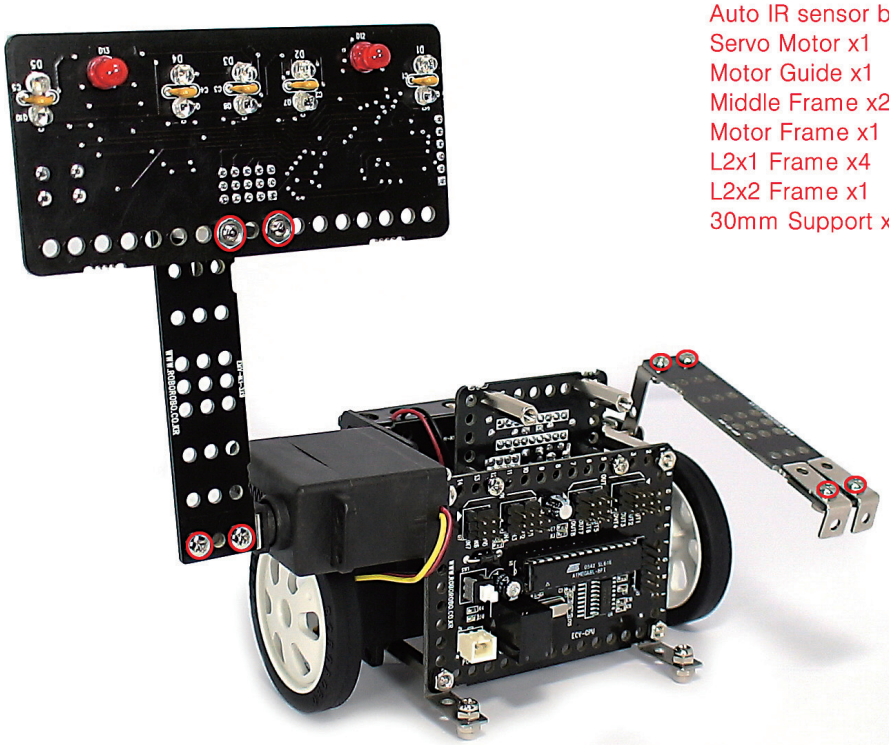
3 Fix the CPU Board and DC Motor Drive Board to the Battery Case as using various supports.
A) Insert the Nut to Bolt ahead and then assemble with Cap Nut.





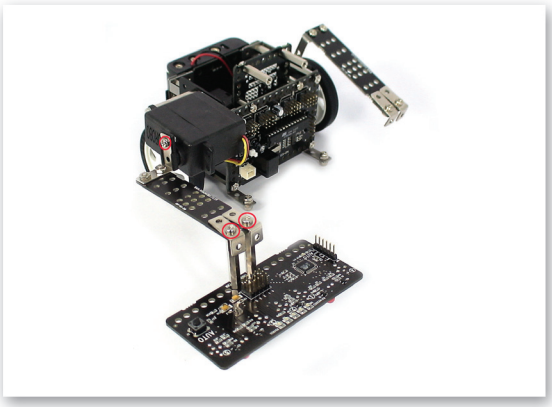
4 Refer to the both pictures taken from different angle.

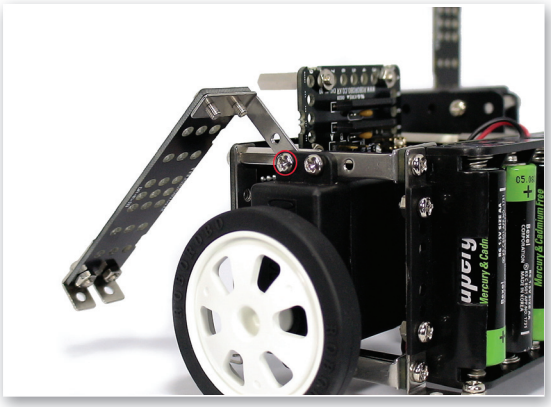
How to Assemble



Auto IR sensor board x1
Servo Motor x1
Motor Guide x1
Middle Frame x2
Motor Frame x1
L2x1 Frame x4
L2x2 Frame x1
30mm Support x2

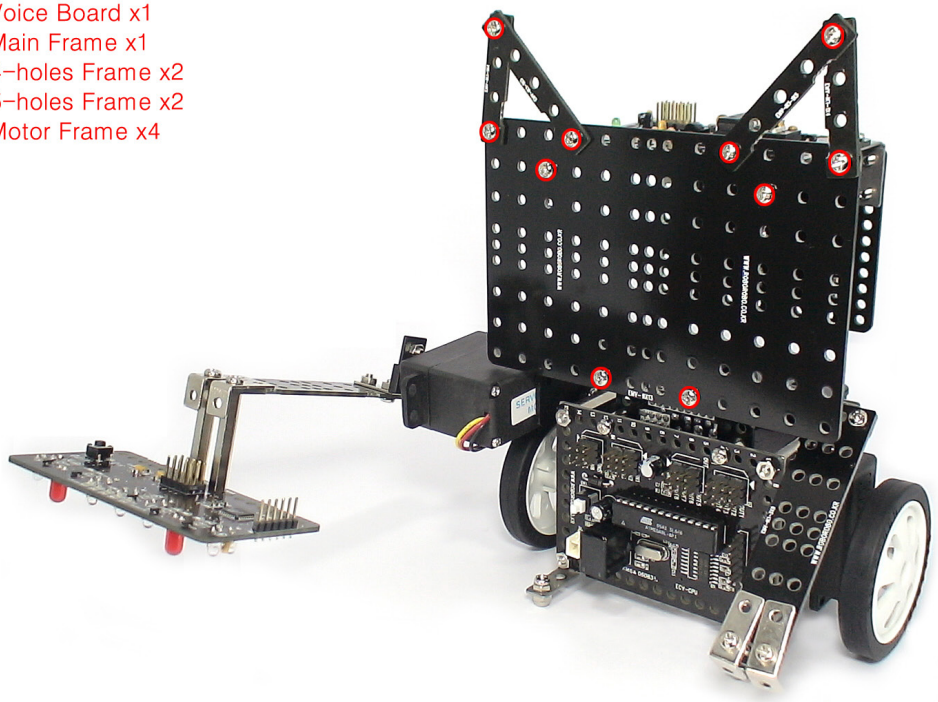
5 Fix the Servo Motor and then connect the Automatic Infrared Sensor Board and make right arm, use the Motor Frame to fix the left arm.



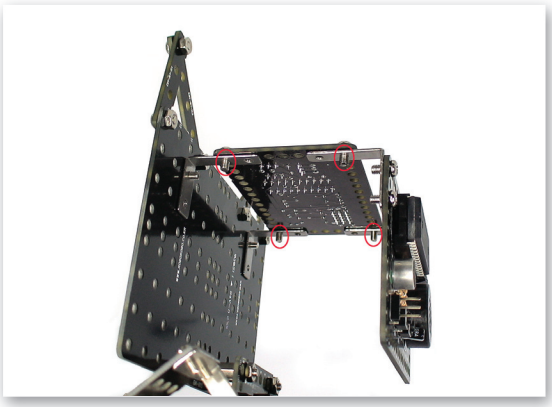


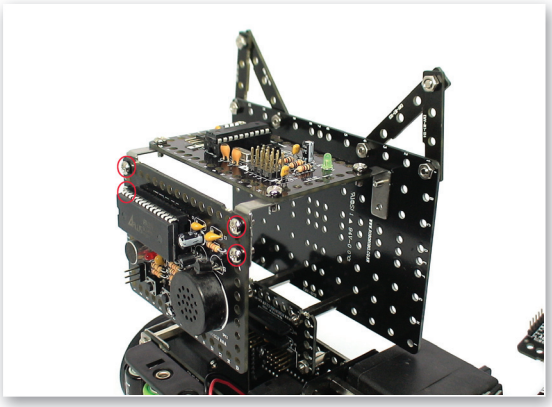
6 Refer to the both pictures taken from different angle.

Remote Control Receiver x1
Voice Board x1
Main Frame x1
4-holes Frame x2
5-holes Frame x2
Motor Frame x4



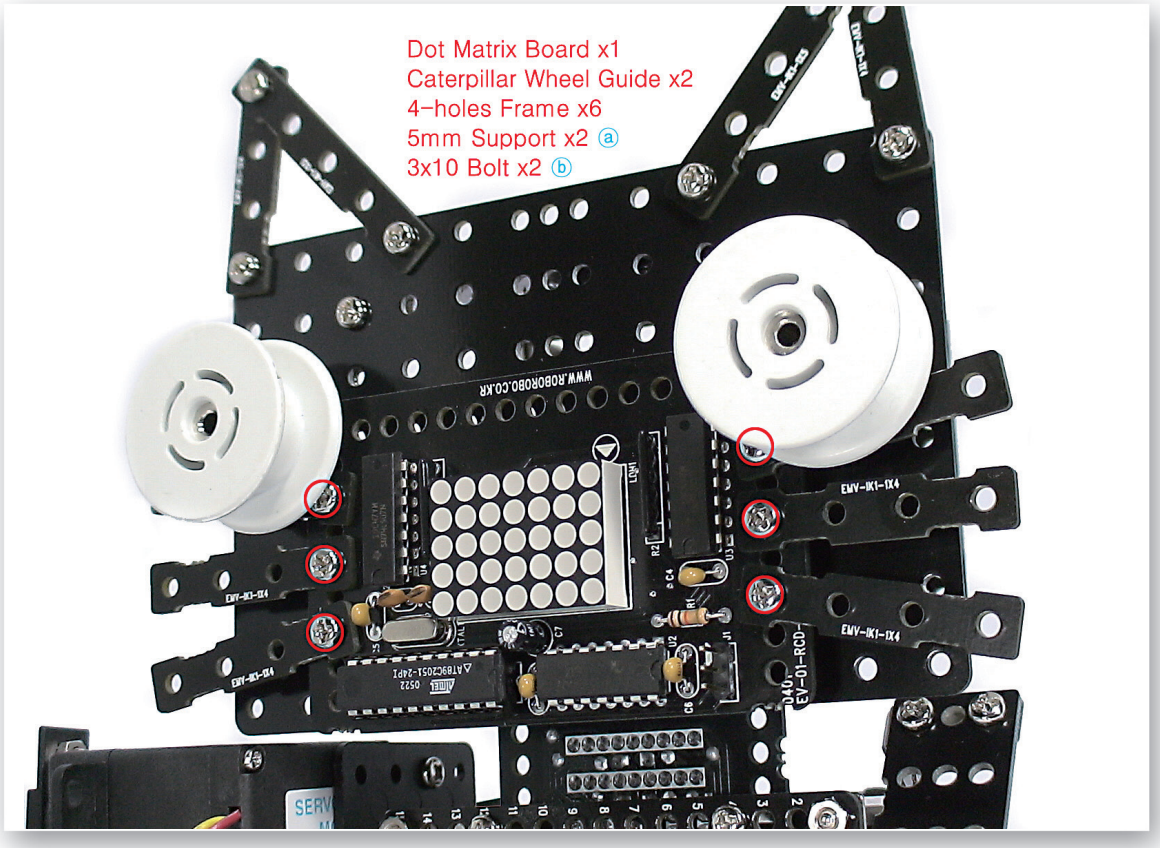
7 Fix the Remote Control Receiver and Voice Board to the Main Frame and make a head.



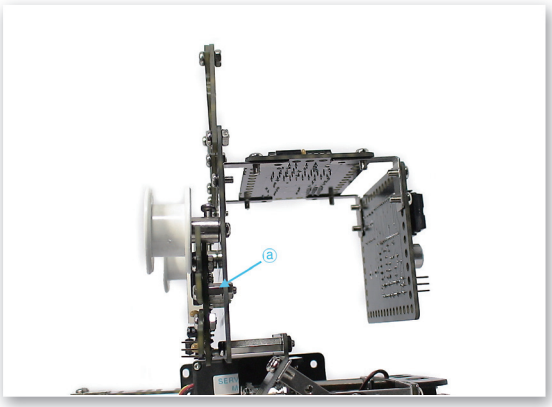


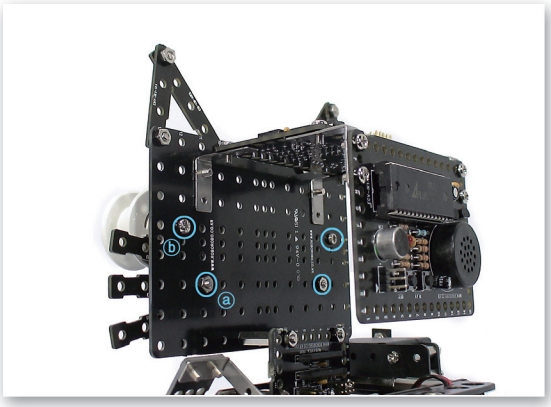
8 Refer to the both pictures taken from different angle.

How to Assemble



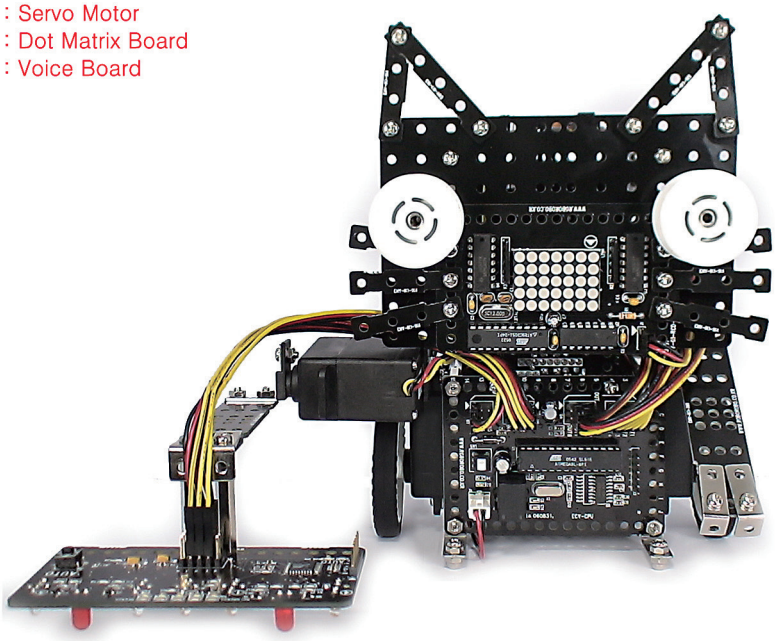
9 Fix the Dot Matrix Board, Caterpillar Wheel Guides and 4-Holes Frames and make a face.



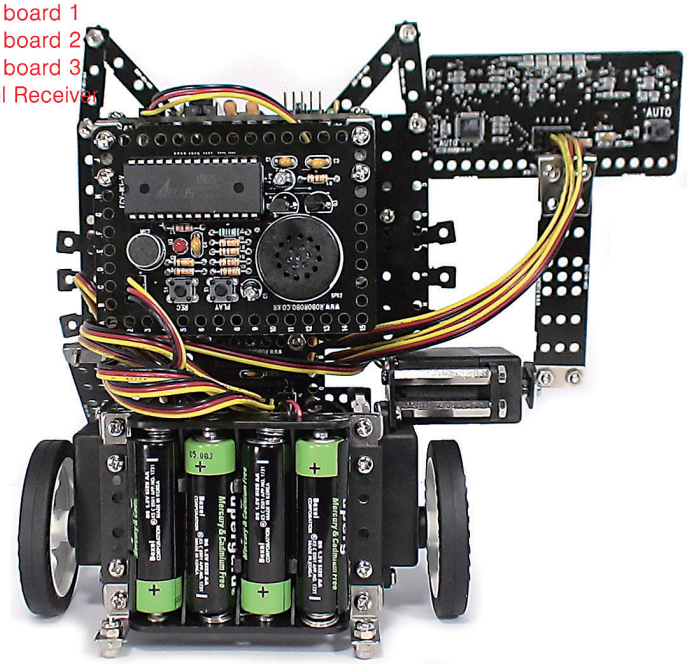


10 Refer to the both pictures taken from different angle.

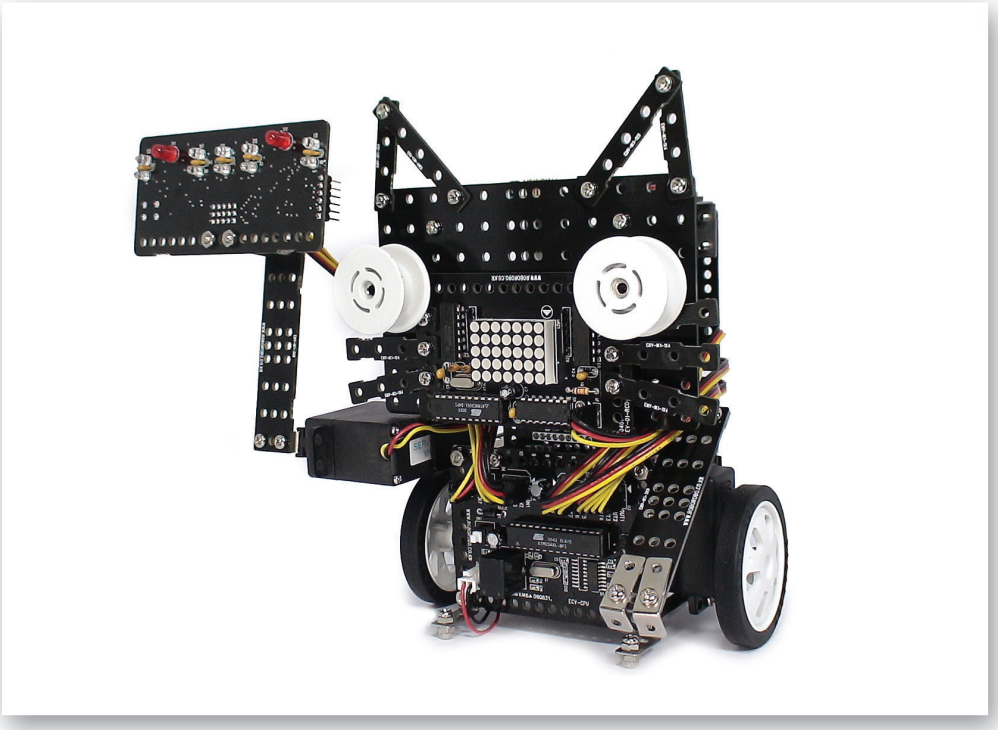
CPU Board
OUT 1~4 : DC Motor Drive Board 1~4
OUT 5 : Servo Motor
OUT 6 : Dot Matrix Board
OUT 7 : Voice Board

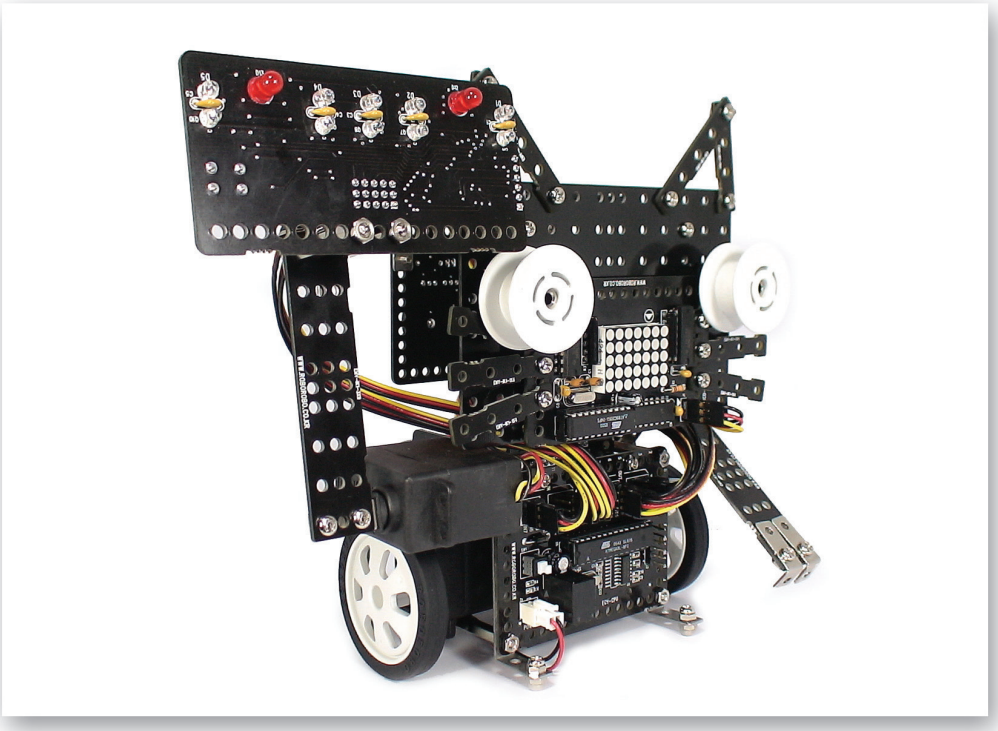


CPU Board
IN 1 : Auto IR sensor board 1
IN 2 : Auto IR sensor board 2
IN 3 : Auto IR sensor board 3
IN 7 : Remote Control Receiver

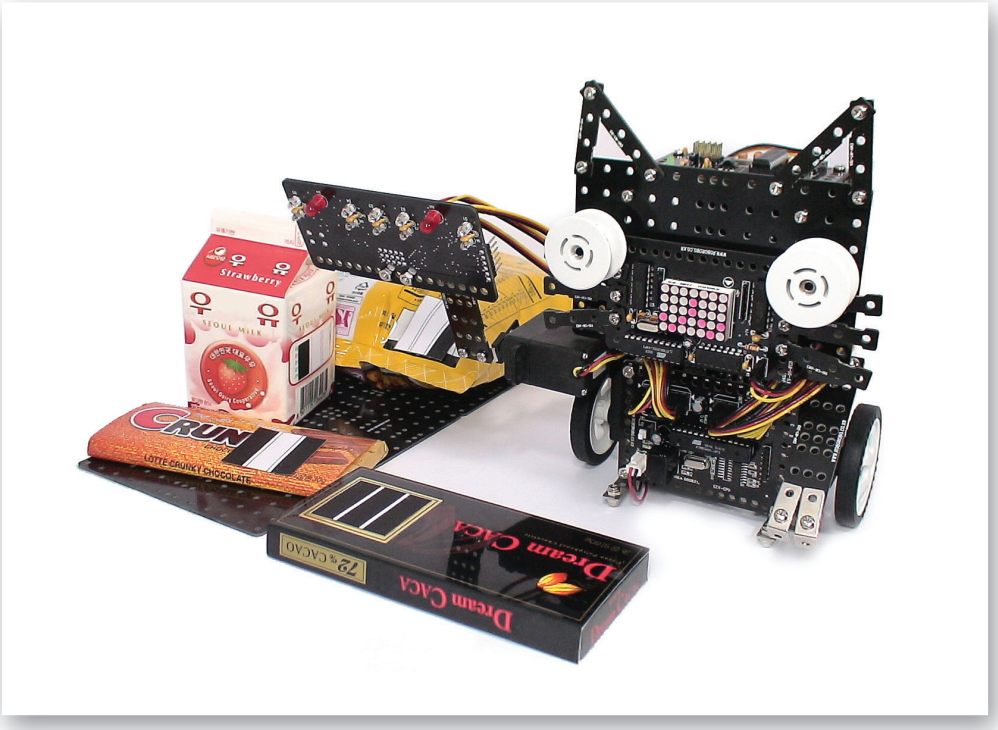


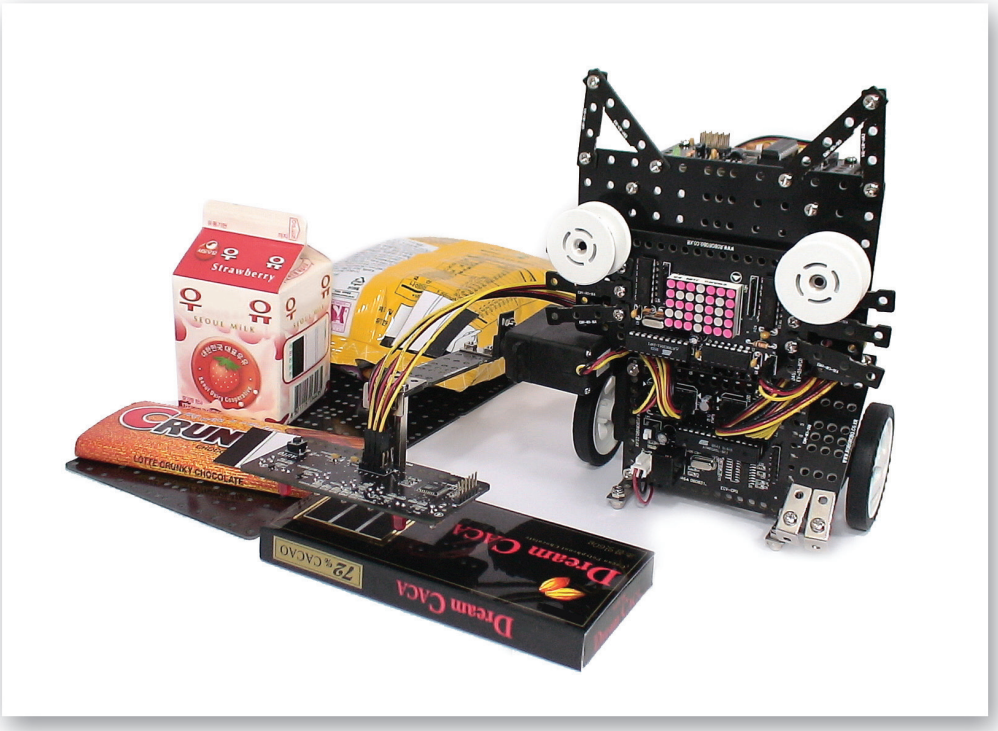
Completed BarcodeBot!





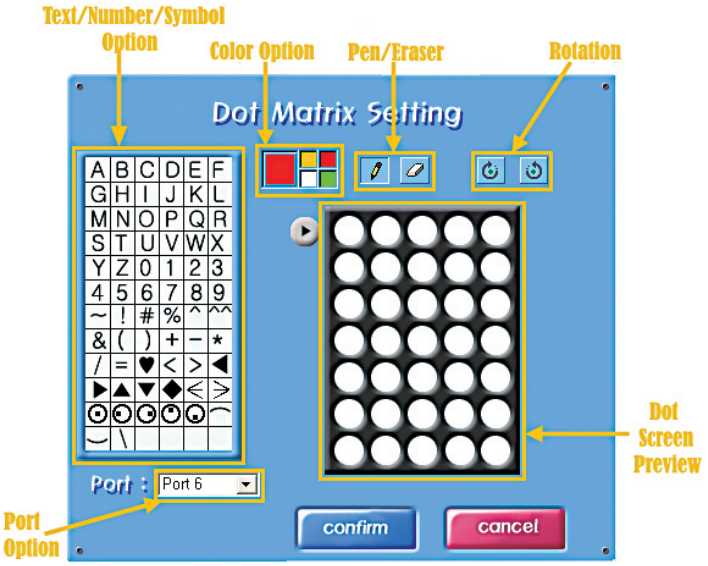
Let's Decorate!





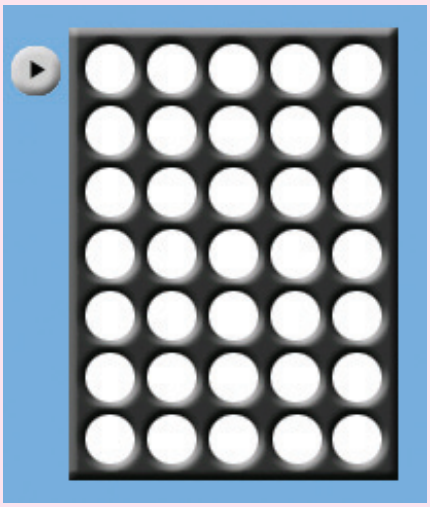
Dot Matrix Chip

- Main Function : It shows characters, numbers or symbols through its dots.
- Application : Input the contents you want to show and set the color and rotating direction.



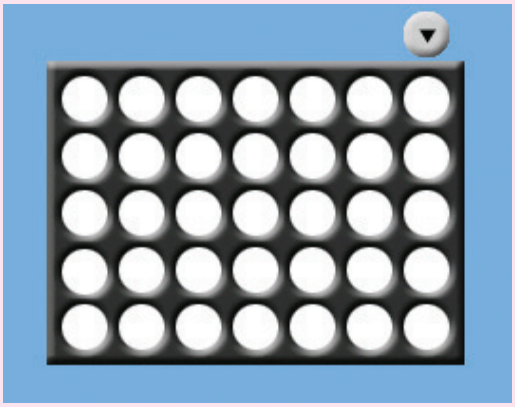
Practice!

Make the alphabet 'A' appear on the Dot Matrix Board.



Practice!

Let the character, number or symbol appear on the Dot Matrix Board in horizontal direction with green color.



Practice!

Let the alphabet ' R, O, B, O, T ' appear on the Dot Matrix Board in order.

What do you have to do to turn off the Dot Matrix Board at the end of program?

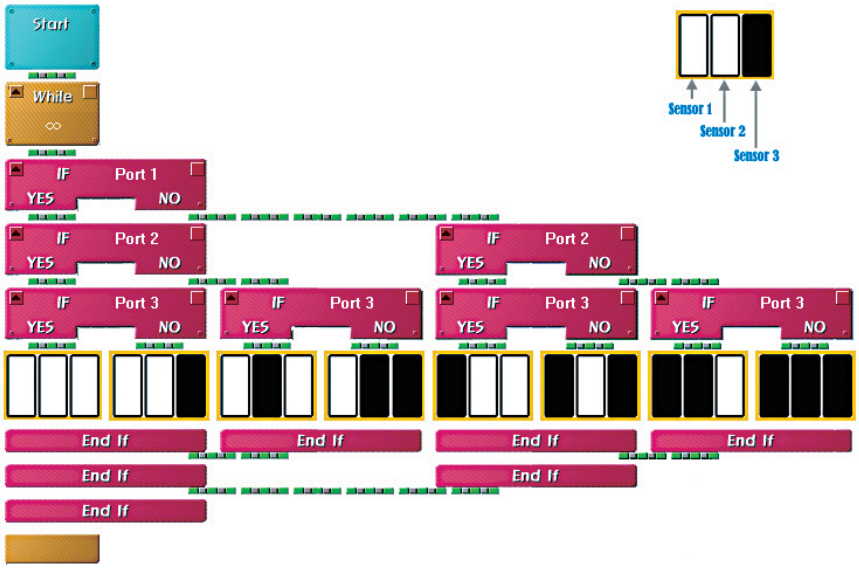
.....

.....

Note) In order to make the Dot Matrix Board blink, you should set at least 0.6 seconds of Delay time.

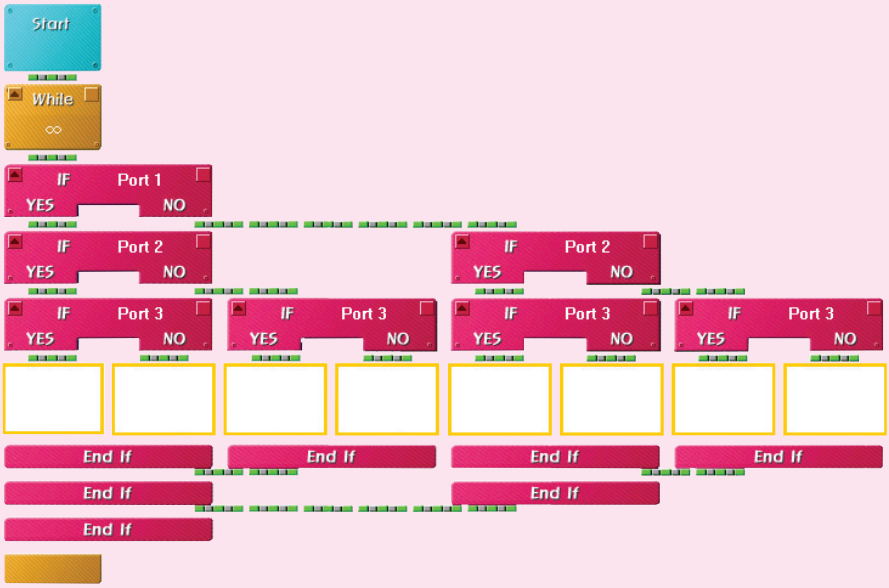
Eight cases of the IF Chips

- Main Function : It indicates the running order of the eight cases.
- Application : According to the case that the three sensors detect white or another case detecting black, put the chips under YES and NO.



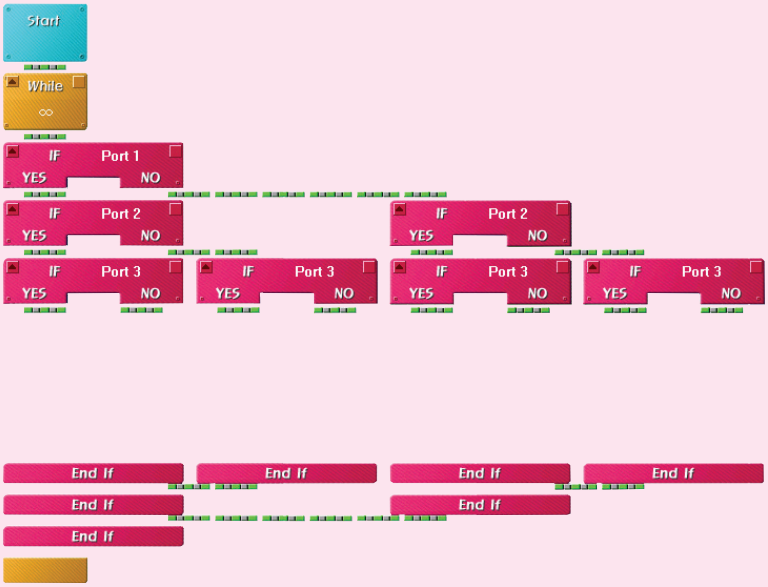
Practice!

Which yellow box do we put into the program in case that 1st part of the IR sensor (Auto) detects black, the 2nd detects white and the 3rd detects black?



Practice!

If the 1st part of the IR sensor (Auto) detects white, the 2nd detects black and the 3rd detects white, show red '♥' on the Dot Matrix Board.



Practice!

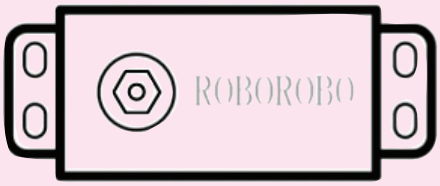
If the 1st part of the IR sensor (Auto) detects white, the 2nd detects black and the 3rd detects white, make the program that '◆' appears on the Dot Matrix Board.

Set the Starting Point of Servo Motor

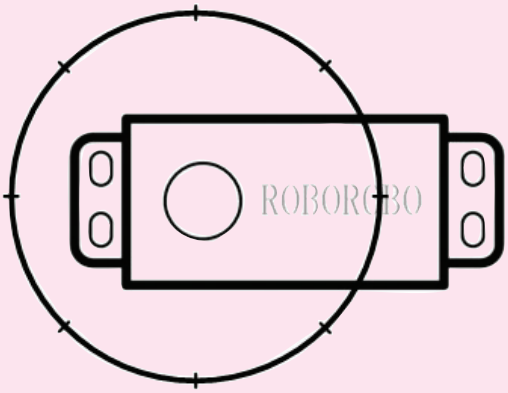
- Main Function : It sets the starting point and rotation radius of the Servo Motor.
- Application : Set the zero point and then fit the Motor Guide to the starting point. Then, Set the radius of rotation with the Servo Motor Chip.

Practice!

Draw the triangular hole and radius of the rotation of Motor Guide.



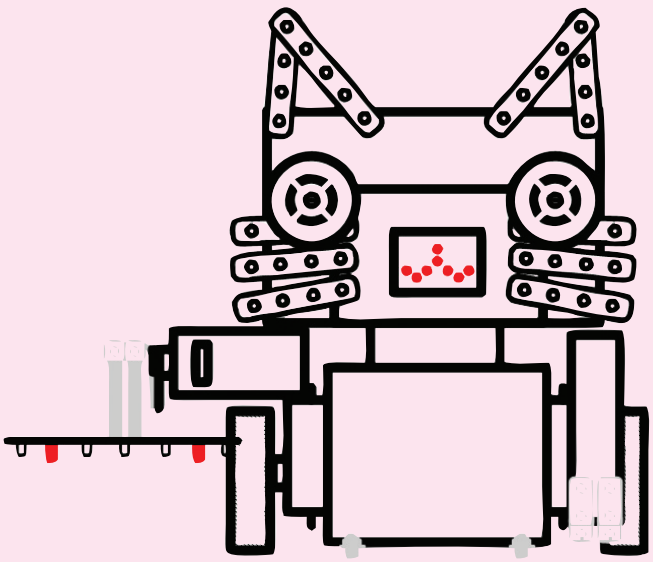
[Starting Point Set up Position]



[Radius of Rotation]

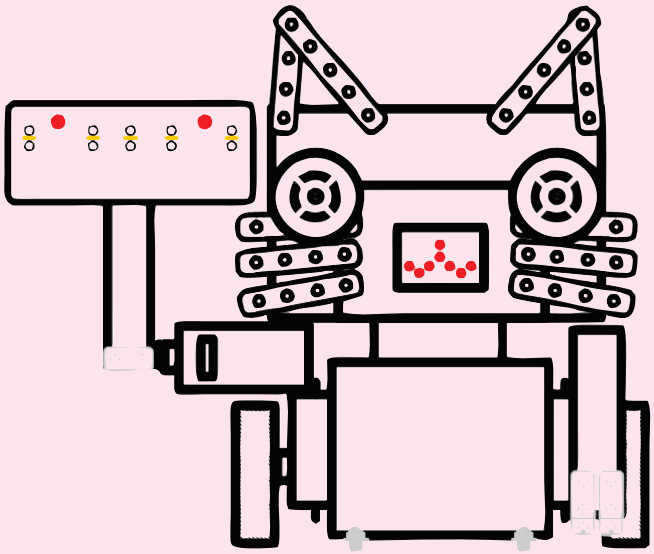
Practice!

Set the Servo Motor Chip to make the robot's hand to put down when reading the barcode.



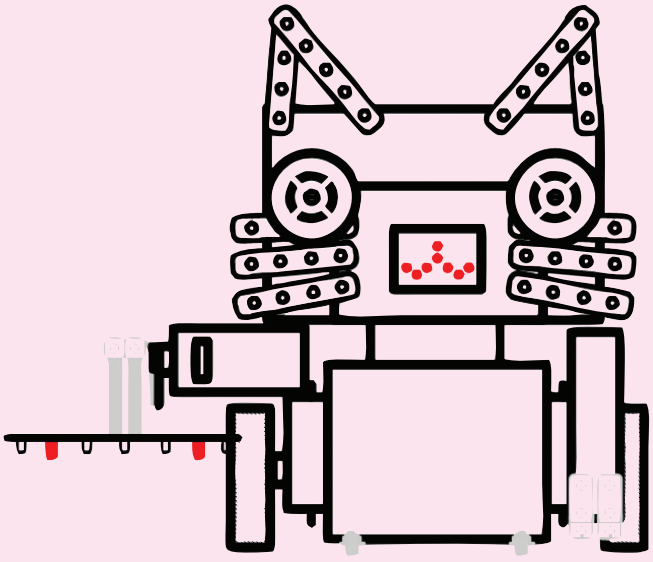
Practice!

Set the Servo Motor Chip to make robot's hand to be pulled up on the move.



Practice!

Tune up the Infrared Sensor to read the bar code when robot's hand is down.



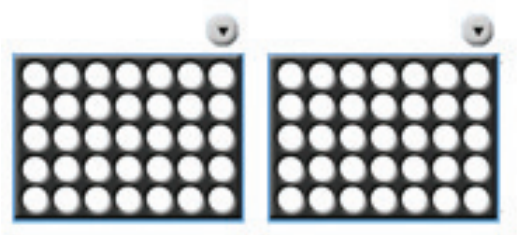
Shall we make it move?

1 Operate the robot to move forward by the button [1] of the Remote Control, move backward by button [2], turn left by [3] and turn right by button [4].

2 Make a program to put down the robot's hand to read the barcode when pressing the button [5] of the Wireless Remote Control.

3 If the robot senses the bar codes in the table below, show the relevant shape on the Dot Matrix Board.

Barcode	Dot Matrix
	▲
	■



Shall we make it move?

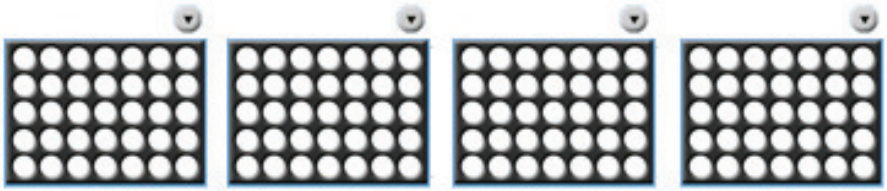
4 Arrange the program to put down the robot's hand for the bar code scanning by the button [5] and display the relevant price.

Barcode	Dot Matrix
	0
	10
	20
	30
	40
	50
	60
	70

What is the purpose of this chip?

.....

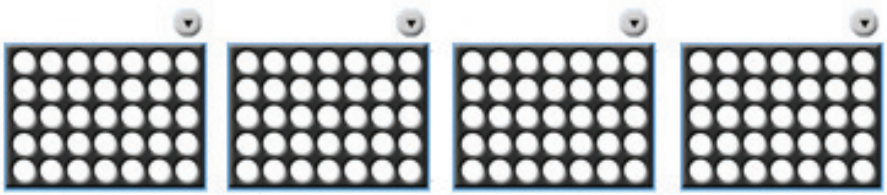
.....



5 If you press the button [5], put the robot 's hand down and display the name and price of the product.

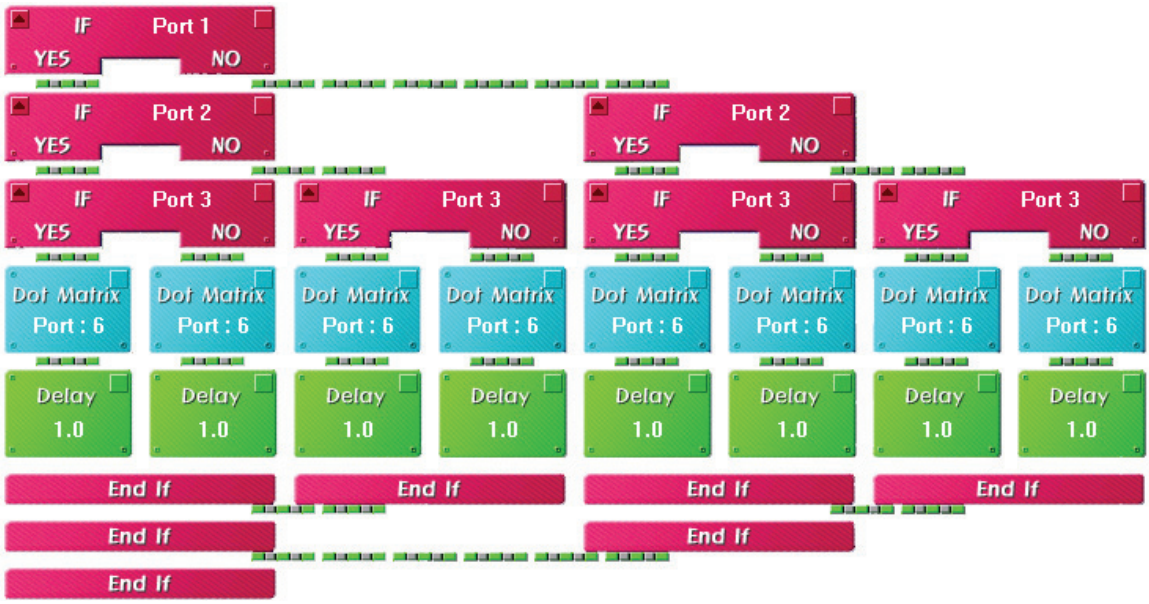
e.g.) If it is in case  , display 'C→H→I→P→30' in order.

6 Combine all programs to apply barcodes like in the mall. Also make it say ' Thank you ' from the Voice Board.

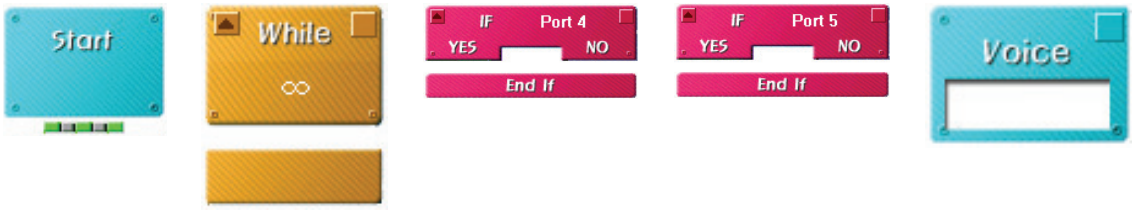


What did you learn?

1. Roborobo Mart tries to use additional 4th and 5th sensors of the IR sensor to read the barcodes more accurately. Try to complete the below program to read the bar codes when both 4th and 5th sensors detect black. And make it alarm by sound if they sense white.

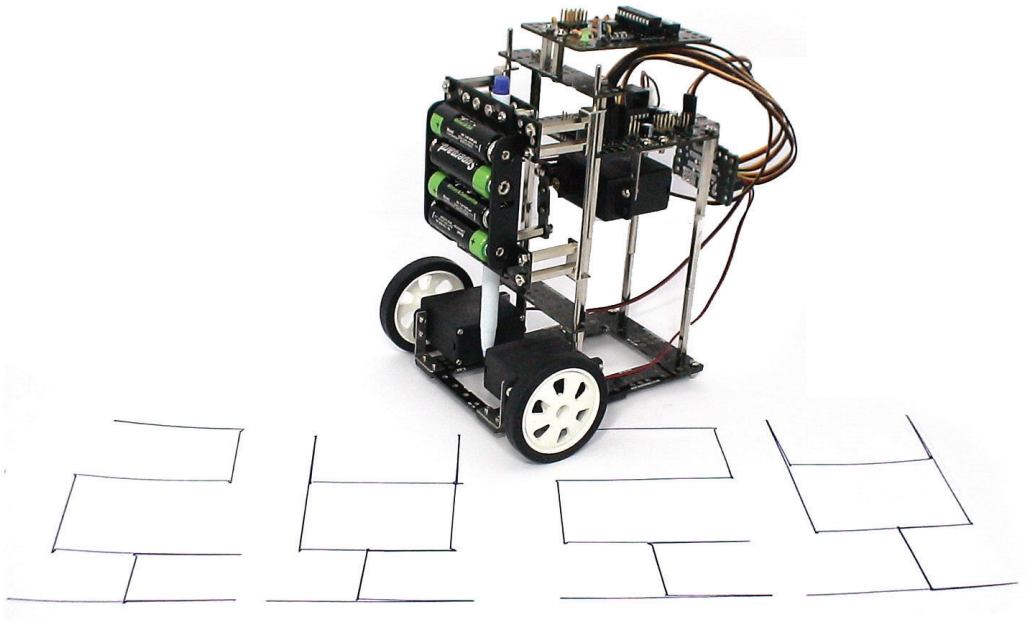


▶Required Chip



Homework	Teacher 's Check

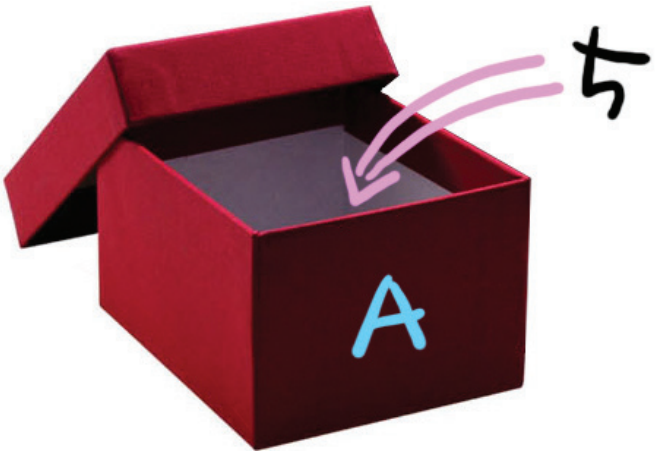
Today's Goal



WritingBot can write letters, words or names by the fixed pen. In this chapter, you can learn Variable Chip and IF Else Chip. These chips help the robot hold up or put down the pen by one button of the Remote Control. Let 's apply the Variable Chip to the program and make the robot write your name!

▶ Variable : Likely to change or vary, a factor that can change in quality, quantity, or size, which you have to take into account in a situation

• • • Variable • • •



[Figure 1]

[Figure 2]

[Figure 1] is an empty box. You can name the box or put some number into the box. The above box is named ' A ' and has ' 5 ' in itself. This box is so special that it can accommodate only one number and you can change the number anytime.

In Rogic Program, this box is a Variable Chip. That is, the Variable Chip means ' a box that can contain the changeable number '. By using this variable, we can compare numbers in the boxes or can add or subtract them.

If so, how can we make the box and put a number in the box on the Rogic Program? Like [Figure 2], you only need to make the Variable Chip named ' A ' and save ' 5 ' inside it.

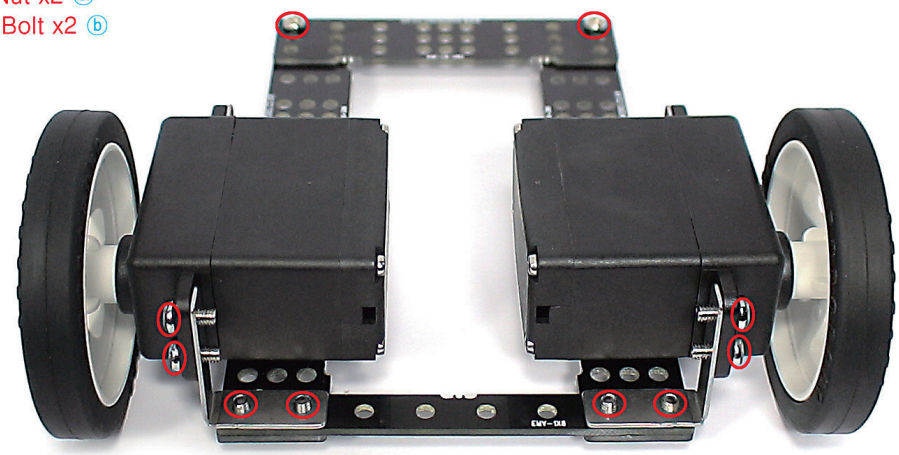
As we mentioned, we can put any number into the Variable whenever we want. The way is to put the different numbers respectively into the same name variables lie [Figure 3] below. If however, same box has various numbers, the program only remembers the finally saved value because one variable can accommodate only one number. Then, what number does [Figure 3] remember? Yes, it is '1' which is lastly saved.

Now, let's find out how to apply the Variable Chip and program the robot by yourself.

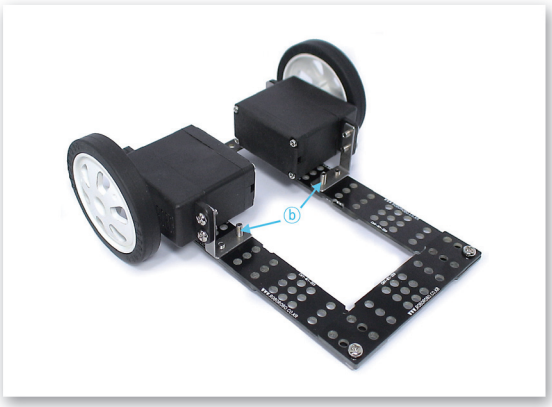
[Figure 3]

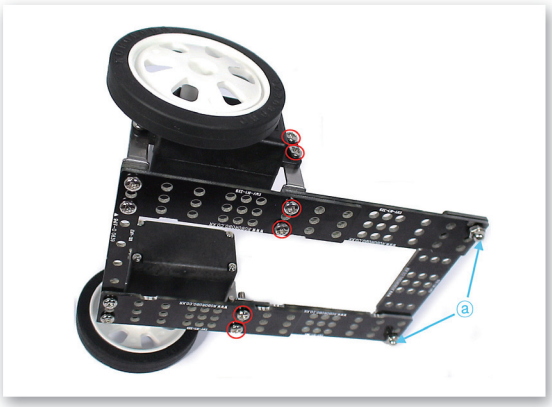
How to Assemble

DC Motor x2
Wheel x2
Middle Frame x5
8-holes Frame x1
Motor Frame x4
Cap Nut x2 ⓐ
3x10 Bolt x2 ⓑ



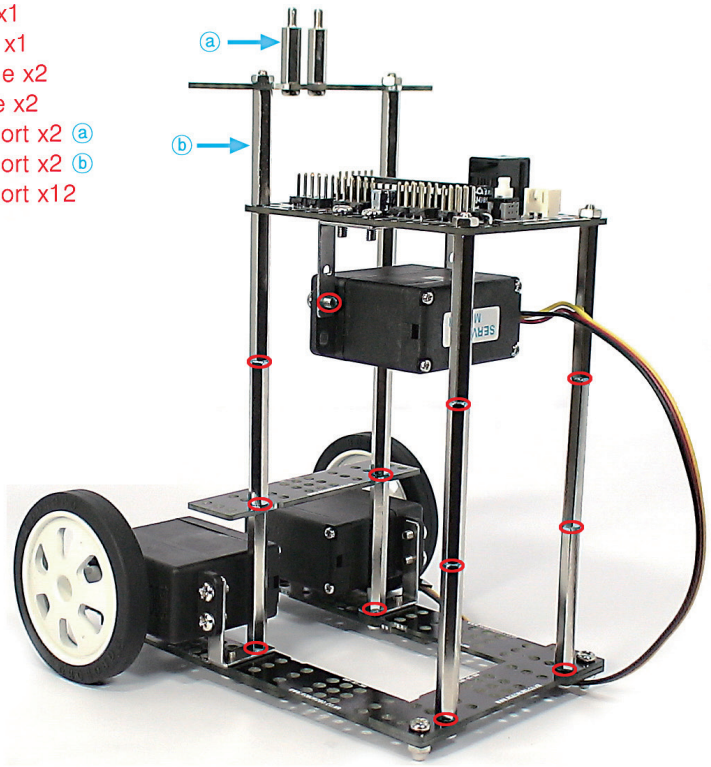
1 Connect the Middle Frames and 8-Holes Frame and make the body of the robot. Fix the DC Motors to the Middle Frames and then insert the Wheels to the DC Motor axles.



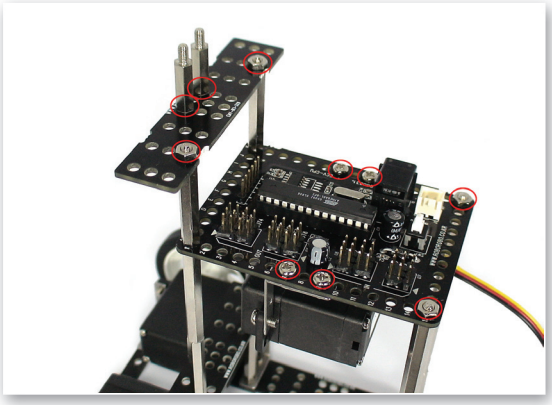


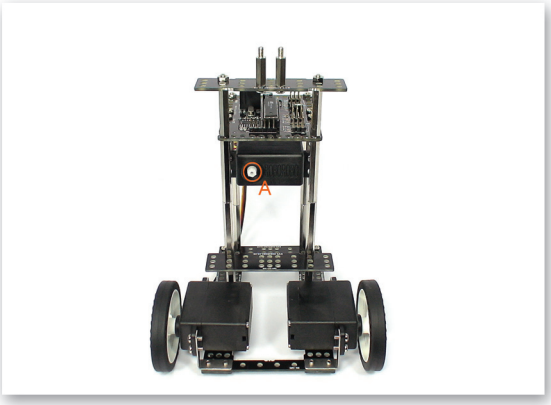
2 Beware on the order of overlapping the Middle Frames and then refer to the both pictures taken from different angle.

CPU Board x1
Servo Motor x1
Middle Frame x2
Motor Frame x2
15mm Support x2 ⓐ
30mm Support x2 ⓑ
40mm Support x12



3 Fix the various Supports to the body of the robot and then connect the CPU Board and the Servo Motor.

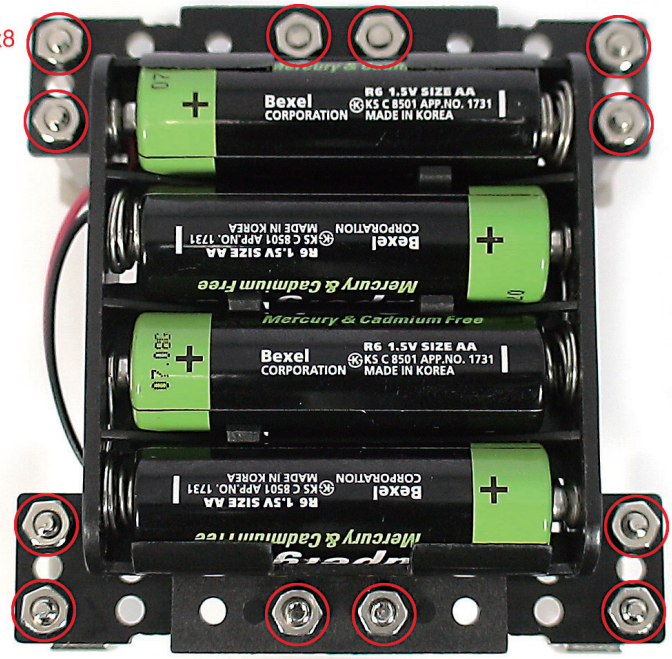




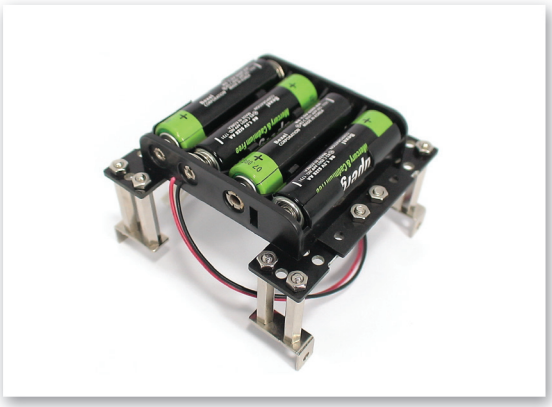
4 Refer to the both pictures taken from different angle.
A) Beware of the direction and assembling the position of the Servo Motor axle.

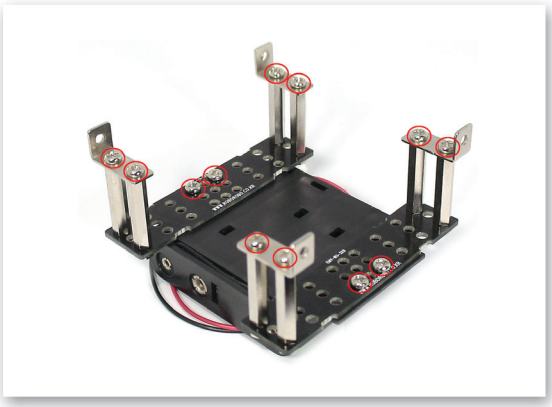
How to Assemble

Battery Case x1
Middle Frame x2
L2x1 Frame x4
25mm Support x8



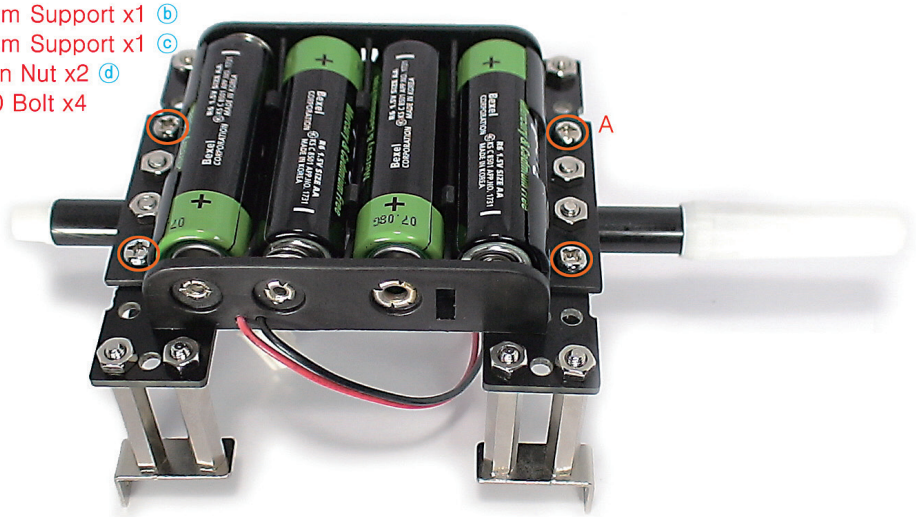
5 Fix the Middle Frames to the Battery Case and then connect the 25mm Supports and L-2x1 Frames to the Middle Frames.



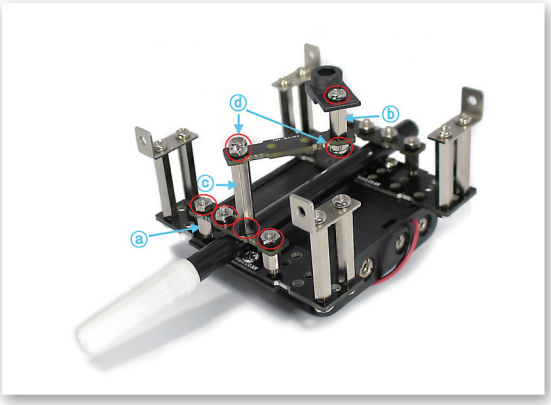


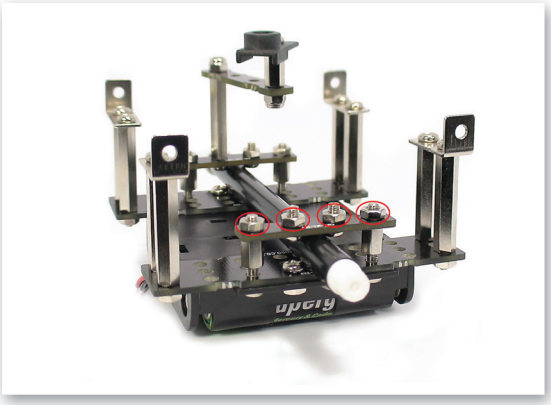
6 Refer to above two pictures taken from different angle.

Motor Guide x1
4-holes Frame x3
7mm Support x4 ⓐ
10mm Support x1 ⓑ
25mm Support x1 ⓒ
Nylon Nut x2 ⓓ
3x10 Bolt x4



7 Connect the 4-Holes Frames and 7mm Supports to the Battery Case and then fix the pen.
By using various supports and Nylon Nuts, fix the Motor Guide.
A) Screw the 3 X 10 Bolt as much as the pen can be fixable.

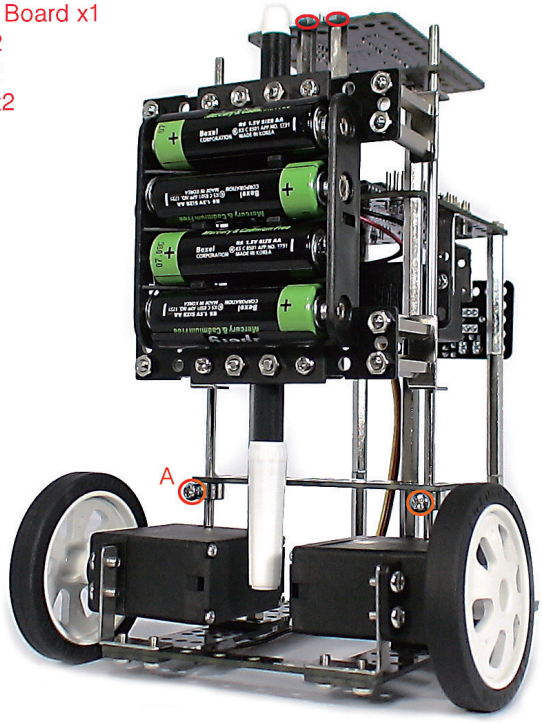




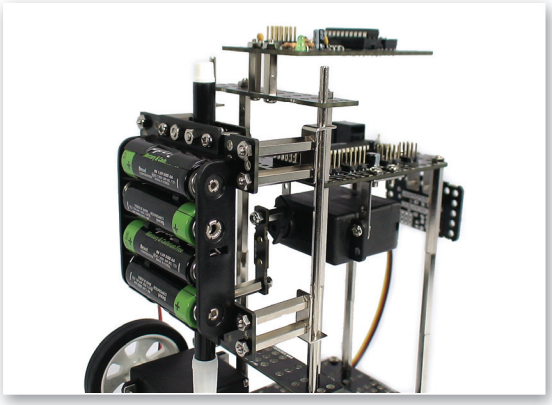
8 Refer to the both pictures taken from different angle.

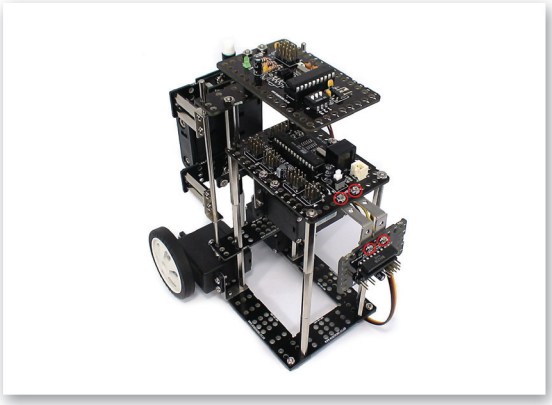
How to Assemble

Remote Control Receiver x1
DC Motor Drive Board x1
Motor Frame x2
140mm Axle x2
Regulable Nut x2



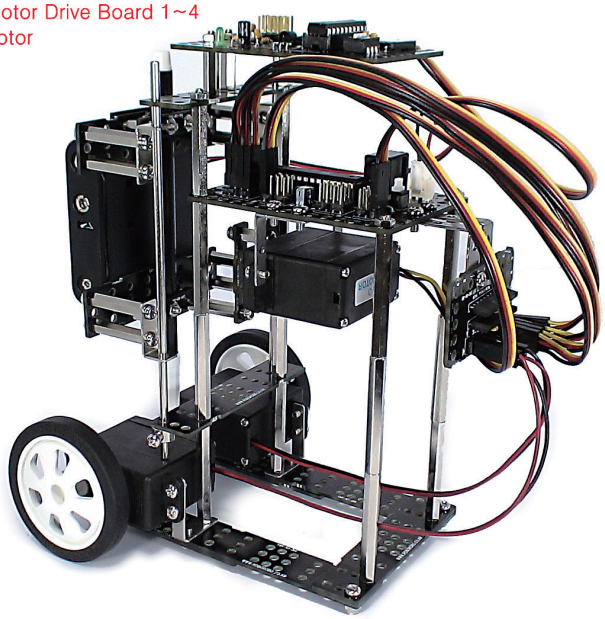
9 Insert the 140mm axles to Middle Frame and then use the Regulable Nuts to fix. Insert the L-Frame that is fixed to Battery Case to the 140mm axles, and connect the Remote Control Receiver and DC Motor Drive Board to the CPU Board.
A) To fix the 140 mm axle, screw the Regulable nut to reach the Middle Frame.



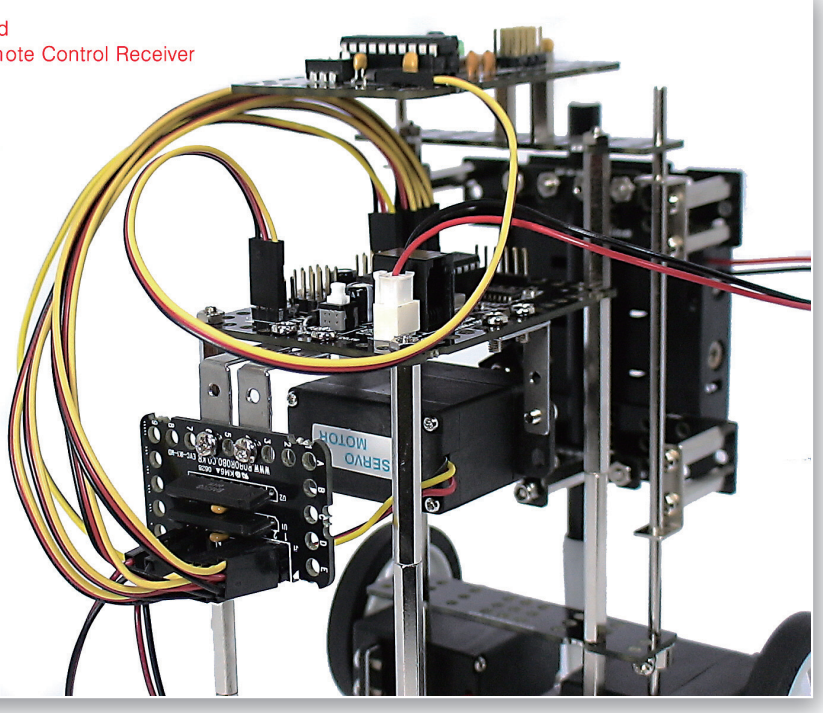


10 Refer to the both pictures taken from different angle.

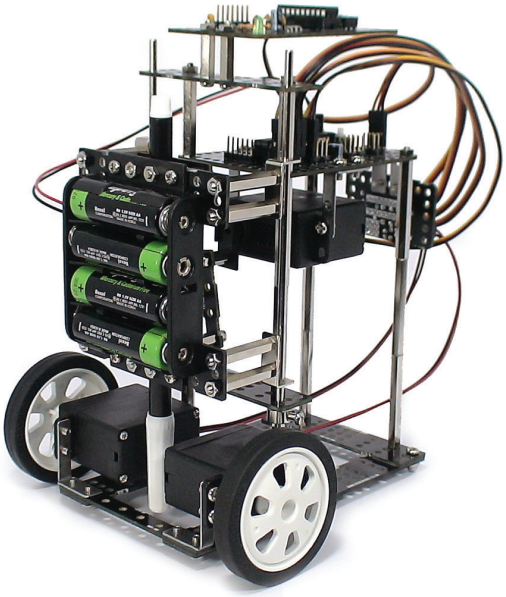
CPU Board
OUT 1~4 : DC Motor Drive Board 1~4
OUT 5 : Servo Motor

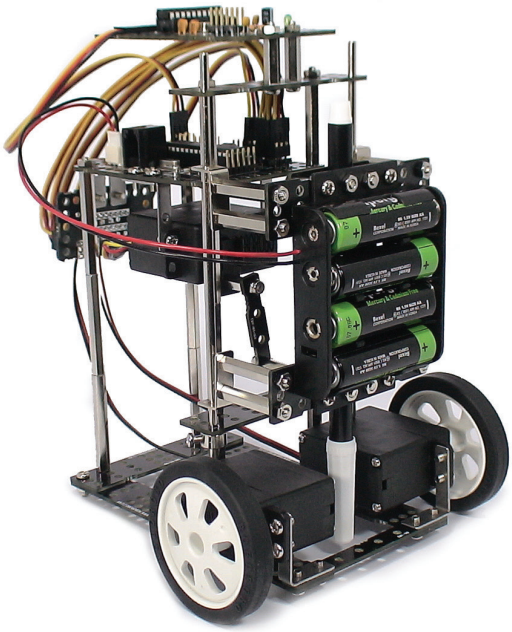


CPU Board
IN 7 : Remote Control Receiver

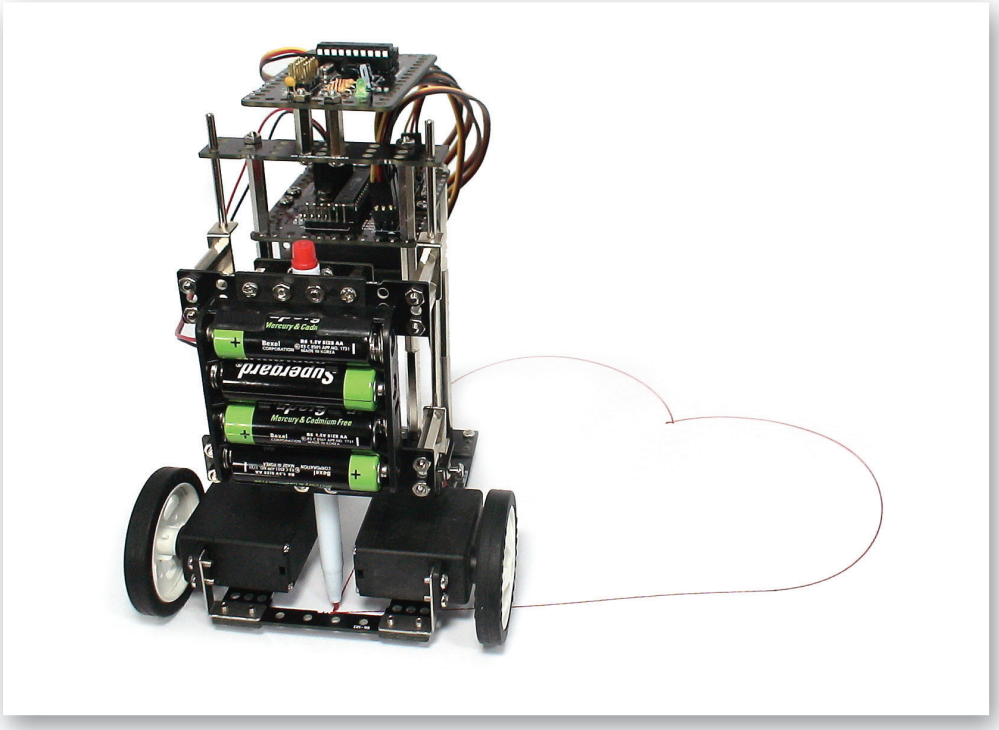


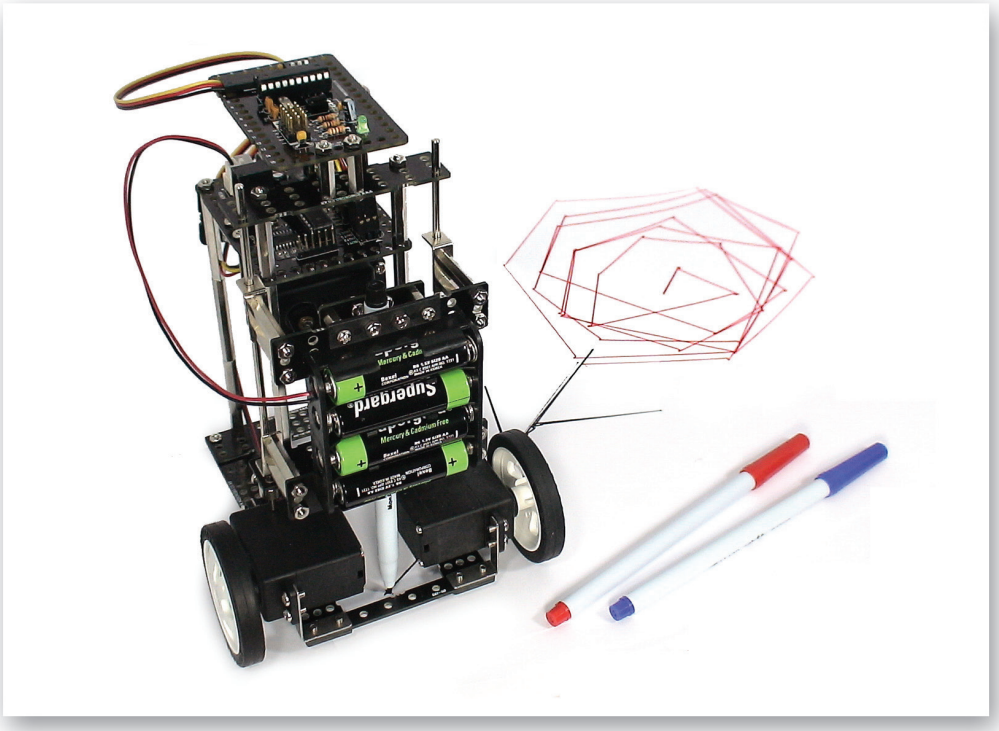
Completed WritingBot!





Let's Decorate!

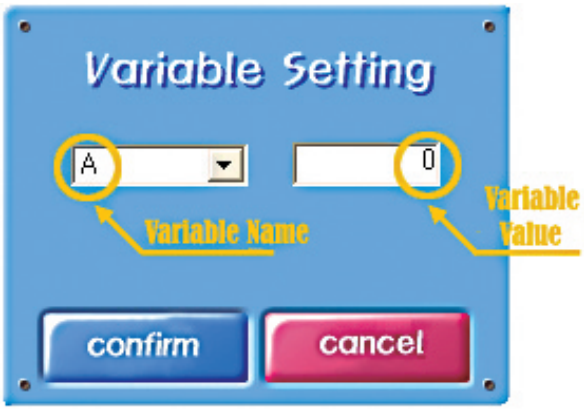




Variable Chip

- Main Function : It can save the value in the letter.
- Application : Name the Variable first, and save the value and then put it to the required position.

[Example]



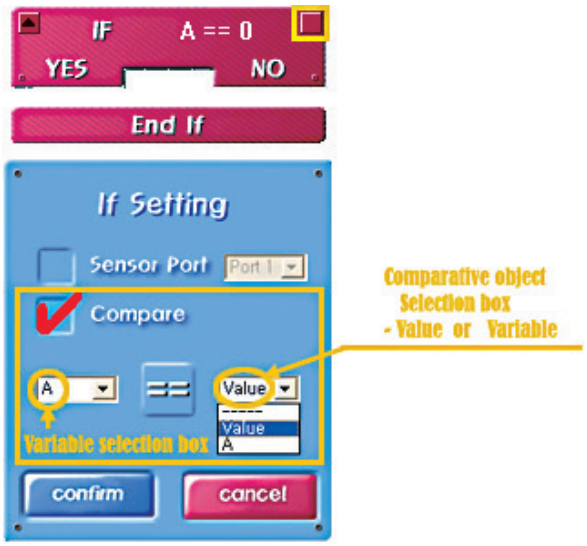
Practice!

Make the Variable Chips arranged below.

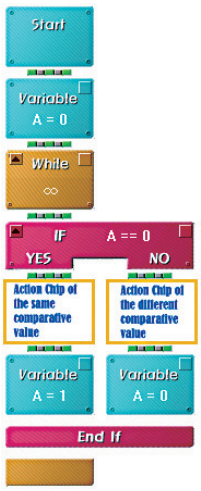
Name	Value	Does it make?		Not-created Reason
AA	10	O	X	
A1	100	O	X	
B1	200	O	X	
11	1	O	X	
1A	1	O	X	
Korean	1	O	X	
A@	1	O	X	

IF Else Chips Comparison Mode

- Main Function : This Chip compares a variable with the selected value or the variable and controls the order and time in which programs are run.
- Application : Insert the action chip under ' Yes' , if same as the selected value.
  Or insert under ' No', if not.

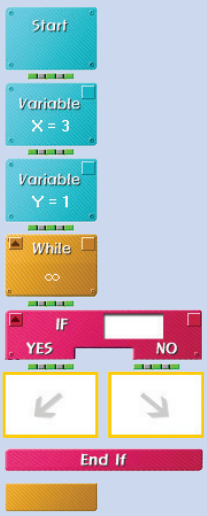


[Example]



Practice!

Set the program to check whether the variable X and Y have the same value. If you run the program, which motion does work first between YES and NO?



What is the reason?

.....

.....

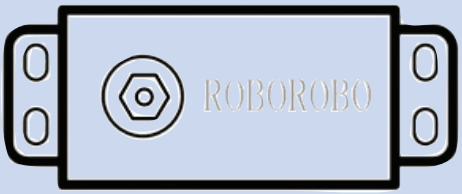
.....

Set the Starting Point of Servo Motor

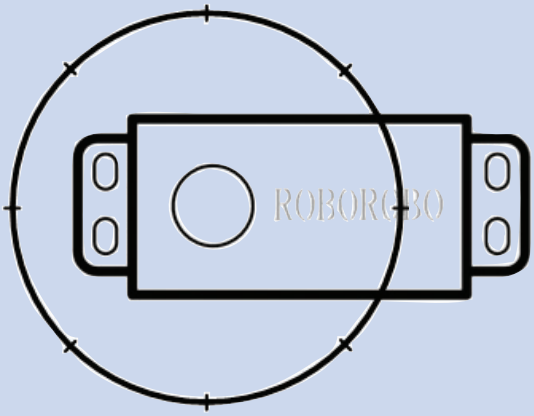
- Main Function : It sets the starting point and rotation radius of the Servo Motor.
- Application : Set the zero point and then fit the Motor Guide to the starting point. Then, Set the radius of rotation with the Servo Motor Chip.

Practice!

Draw the radius of rotation of the triangular hole and the Motor Guide.



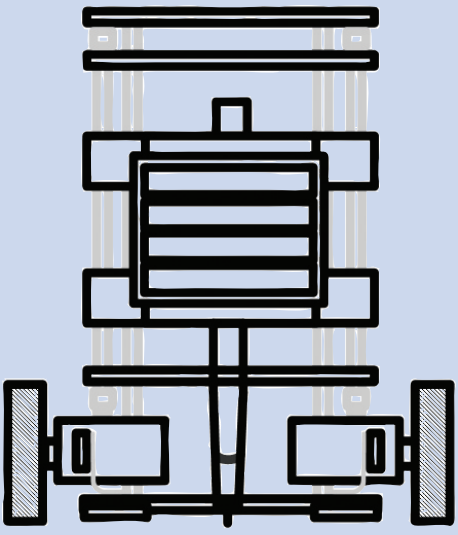
[Starting Point Set up Position]



[Radius of Rotation]

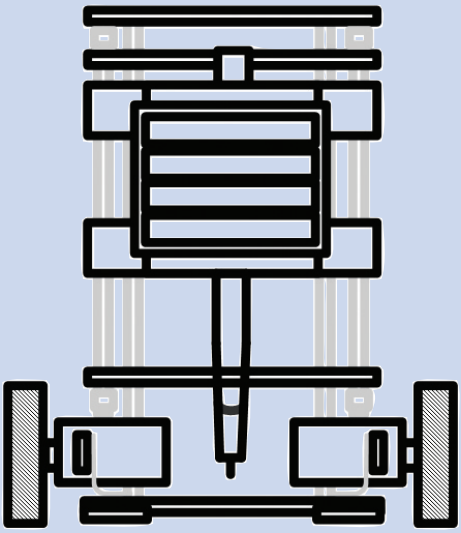
Practice!

Set the Servo Motor to make the pen reach the paper when writing.



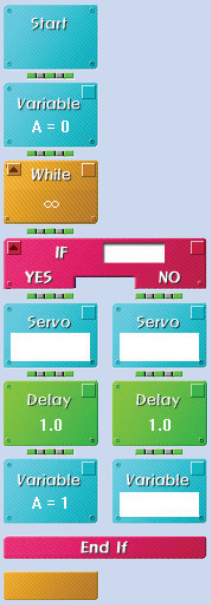
Practice!

Set the Servo Motor to pull up the pen while moving.



Practice!

Make a program of the repeated motion that makes the pen reach the paper and pulls it up using a variable and IF Chip.



Shall we make it move?

1 Make your robot move forward when pressing the button [1] of the Wireless Remote Control, move backward with button [2], turn left with [3] and turn right with button [4].

2 Make the pen reach the paper by the button [5] at once and pull up the pen if pressing again.

3 Operate the robot to write down ‘ ㄱ, ㄹ, ㅅ, ㅇ ’ on the wide paper by the Remote Control.

4 Write down your name by the Robot using the Remote Control.

Shall we make it move?

5 Draw ' ♡ ' on the paper with your robot.

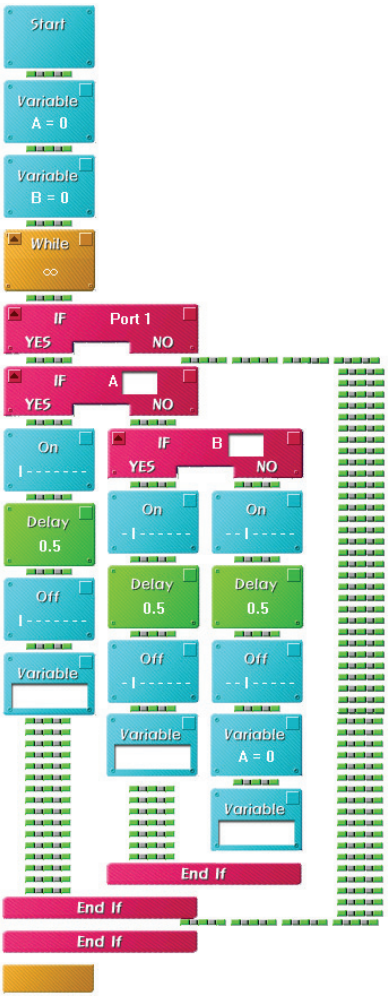
6 Draw ' ☆ 'on the paper with your robot.

7 Draw a beautiful flower with your robot.

8 Draw or write anything you want by the Robot using the Remote Control.

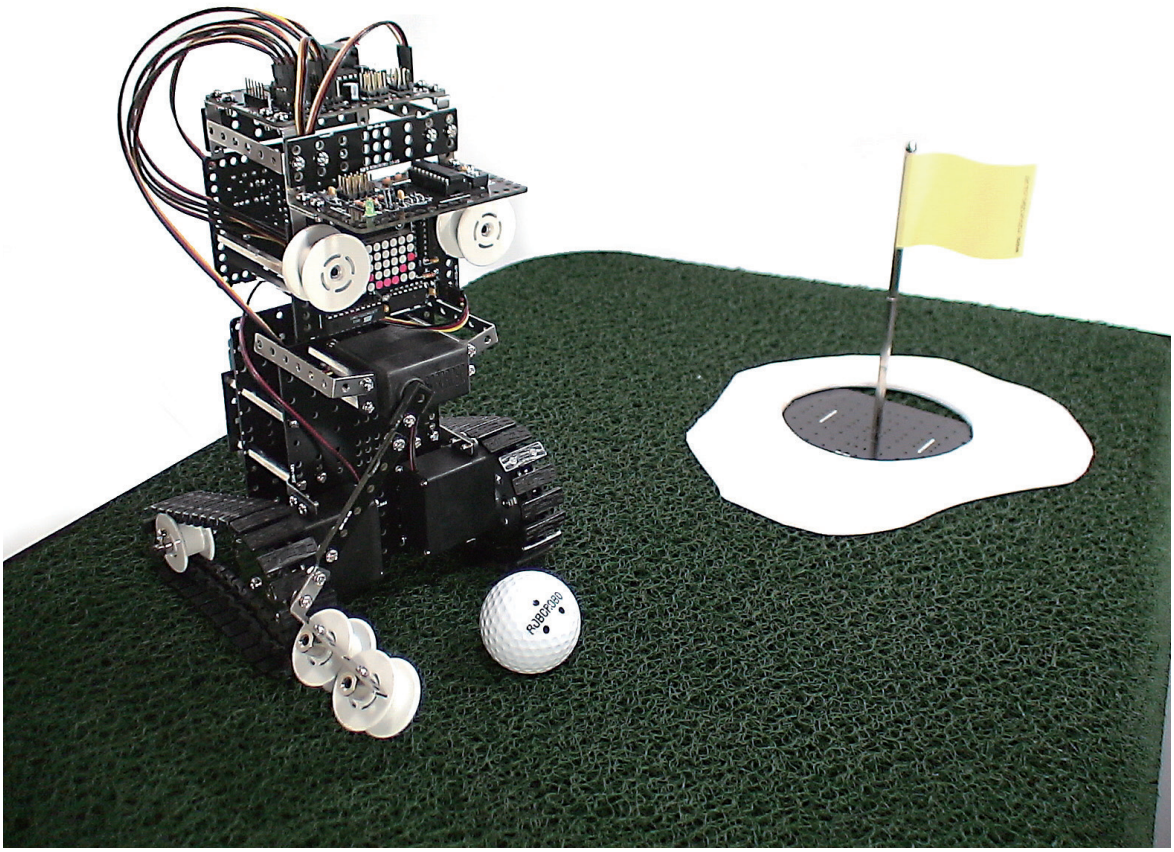
What did you learn?

1. Dexter wants to turn on the LED (that is connected to OUT Port 1, 2 and 3) one by one in order every time he presses the button. Why don' t you help Dexter complete the program?



Homework	Teacher 's Check

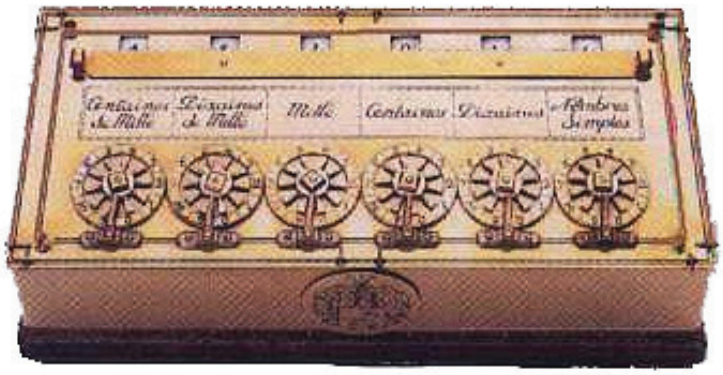
Today's Goal



GolfBot is a golf robot playing a ball with a club which is connected to the Servo Motor. This robot can put the ball into the hole by several steps of the stroke. Let 's move the robot 's motion to hit balls strongly or roll gently by the Calculate Chip. Try to do the addition, subtraction, multiplication and division with the Calculate Chip and the let 's play the golf game. Who does put the balls into the hole with the fewest strokes?

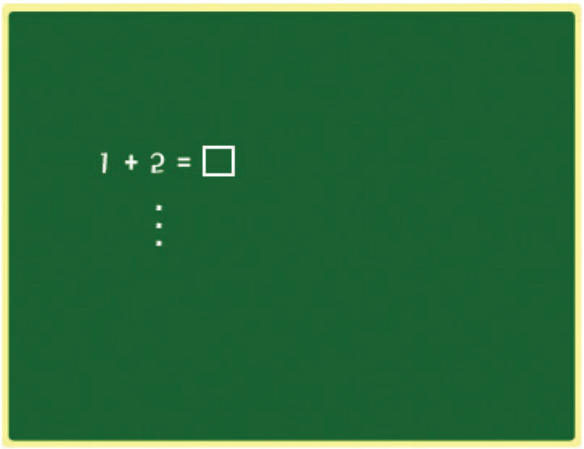
▶ Golf : A precision club-and-ball sport, in which competing players (golfers), using many types of clubs, attempt to hit balls into each hole on a golf course while employing the fewest number of strokes
▶ Calculate : To work out a number, etc

Calculation

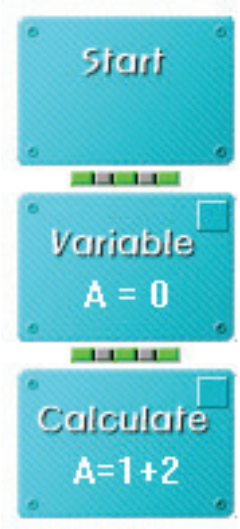


How many times do we calculate in a day? When we buy in the mall, when we solve a math problem or when we estimate how many times we left to finish the school, we always calculate.

Since the primitive age, human beings have done the ' Calculation '. They drew the line on the bones or count by fingers. About 4,000 years ago, humankind could estimate the celestial period and nowadays Arabic numerals are widely used in daily lives. We deal with many things related to figures depending on electronic brain from calculators to computers.



[Figure 1]



[Figure 2]

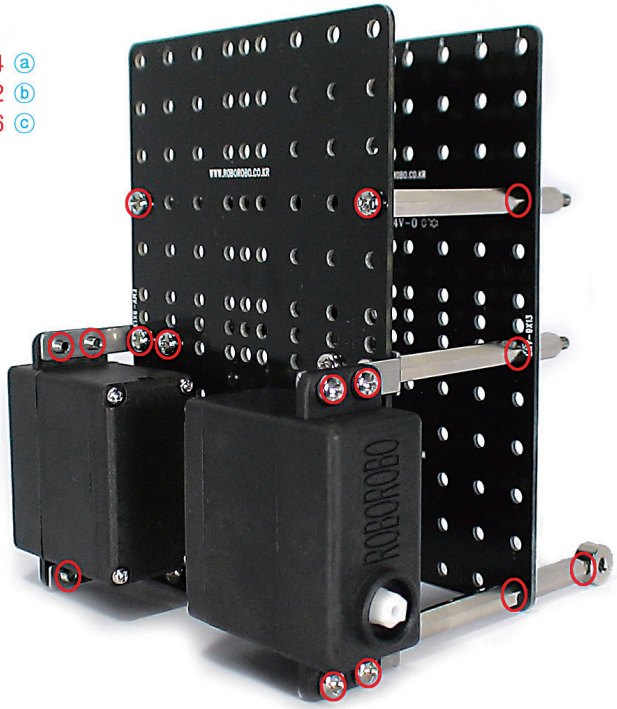
There are several types of Calculation; Addition, subtraction, multiplication, division and alphabetical calculations like $(a+b)^2$ etc. Among them, the four fundamental arithmetic operations is a general term for the general term for addition, subtraction, multiplication and division.

The [Figure 1] is an example of the four fundamental arithmetic operations. And [Figure 2] shows it in the rogic program. Did you find the difference between two figures? In mathematics, we can calculate with numbers and arithmetic operators (+-×÷). However, in the rogic program, we need a box to keep the result of the calculation, that is, variation A is additionally required.

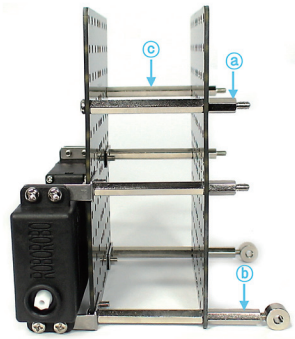
When you use Calculate Chip, larger the number is, higher the speed gets and vice versa. Why don't you control the robot's motion and speed by the Calculate Chip?

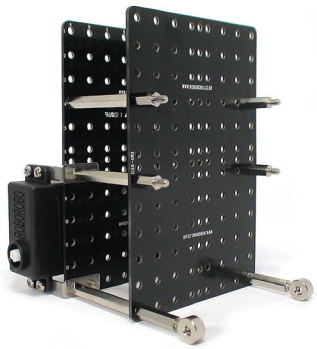
How to Assemble

DC Motor x2
Main Frame x2
Motor Frame x4
10mm Support x4 ⓐ
20mm Support x2 ⓑ
40mm Support x6 ⓒ
Regulable Nut x2



1 Fix the DC Motors to the Main Frame with Motor Frame and 40mm Supports and then fix another Main Frame on the opposite. Connect the Regulable Nuts to the 20mm Supports.

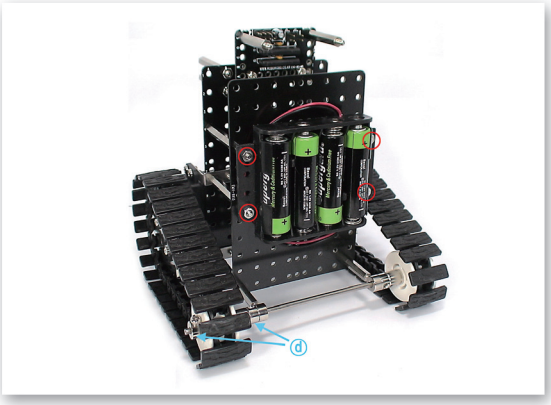


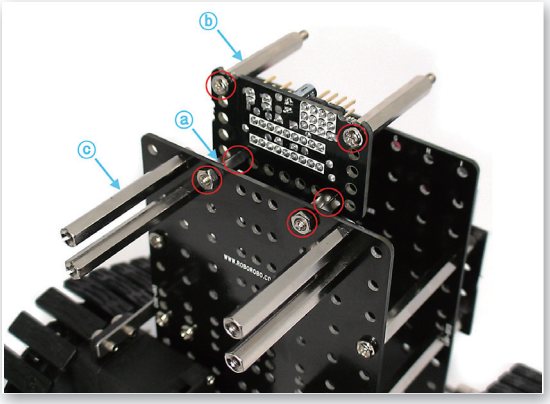


2 Refer to the both pictures taken from different angle.

DC Motor Drive Board x1
Battery Case x1
Caterpillar Wheel x2
Wheel Guide x2
Caterpillar Wheel Guide x2
140mm Axle x1
10mm Support x2 ⓐ
35mm Support x2 ⓑ
40mm Support x4 ⓒ
Regulable Nut x4 ⓓ
2.6x10 Bolt x2
Each 31 Caterpillars for two tracks

3 Fix the DC Motor Drive Board and Battery Case to the Main Frame. Insert the Caterpillar Wheel Guides into the DC Motor axle and connect the Caterpillar Wheels to 140mm axle and then fix the Caterpillars.

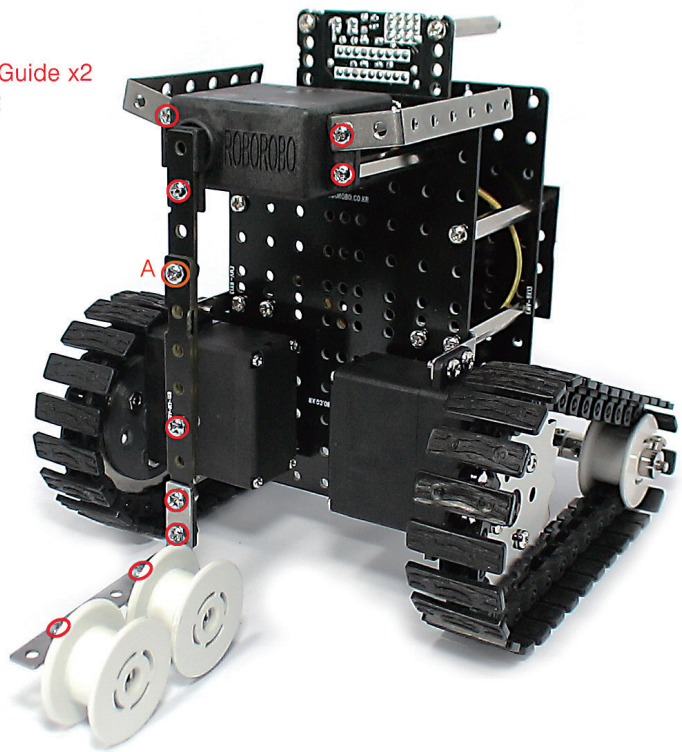




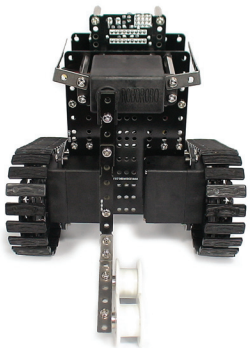
4 Refer to the both pictures taken from different angle.

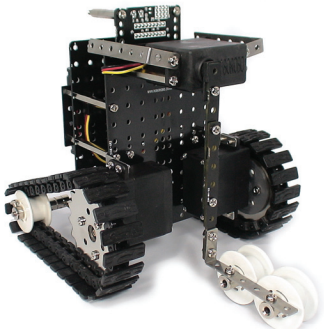
How to Assemble

Servo Motor x1
Motor Guide x1
Caterpillar Wheel Guide x2
8-holes Frame x2
L2x6 Frame x3



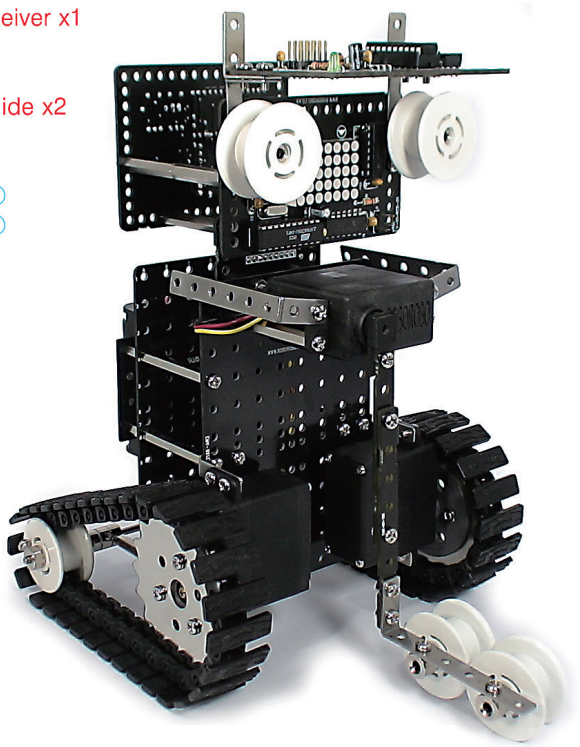
5 Fix the Servo Motor to Main Frame and then connect the 8-Holes Frames and Caterpillar Wheel Guides and make a golf club.
A) Connect as overlapping two 8-Holes Frames.



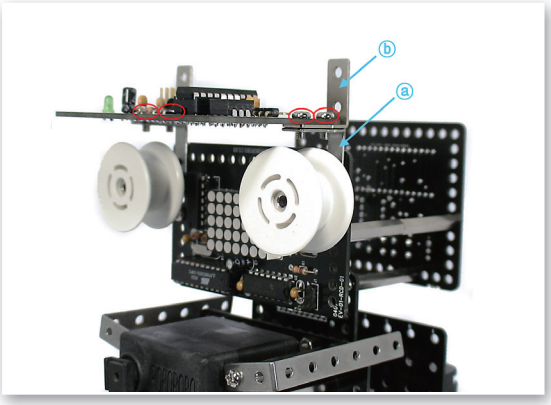


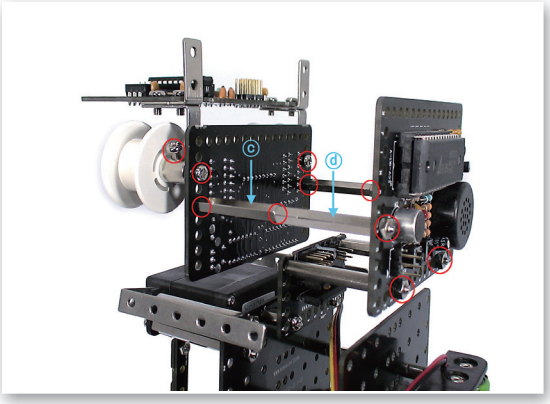
6 Refer to the both pictures taken from different angle.

Remote Control Receiver x1
Dot Matrix Board x1
Voice Board x1
Caterpillar Wheel Guide x2
Motor Frame x2 ⓐ
L2x2 Frame x2 ⓑ
30mm Support x2 ⓒ
35mm Support x2 ⓓ
3x10 Bolt x2



7 Connect the Remote Control Receiver, Voice Board and Caterpillar Wheel Guides to the Dot Matrix Board and make a face.

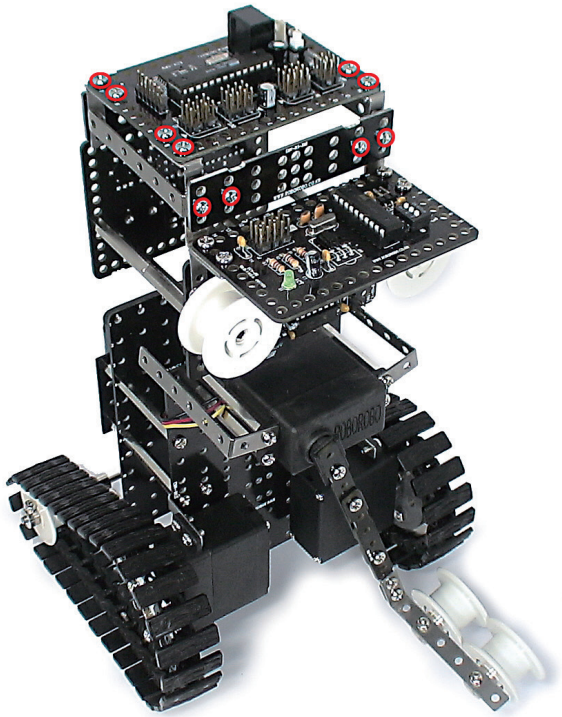




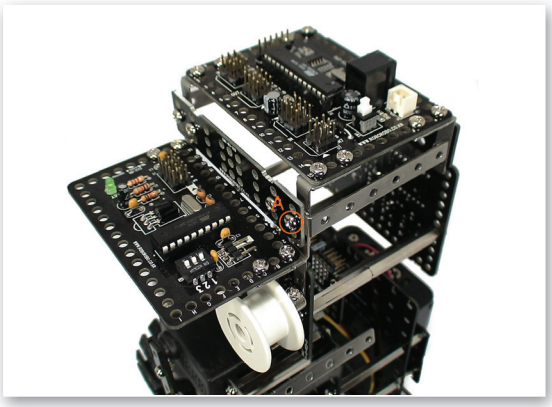
8 Refer to the both pictures taken from different angle.

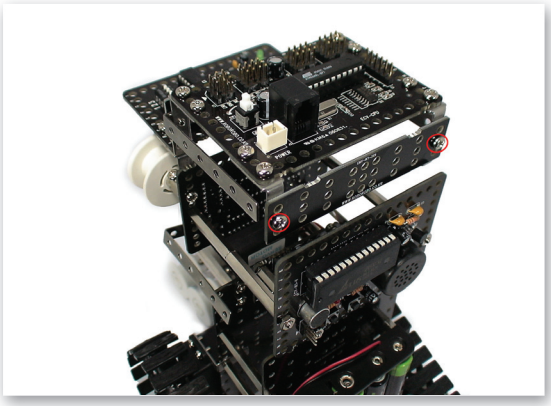
How to Assemble

CPU Board x1
Middle Frame x2
Motor Frame x4
L2x6 Frame x2



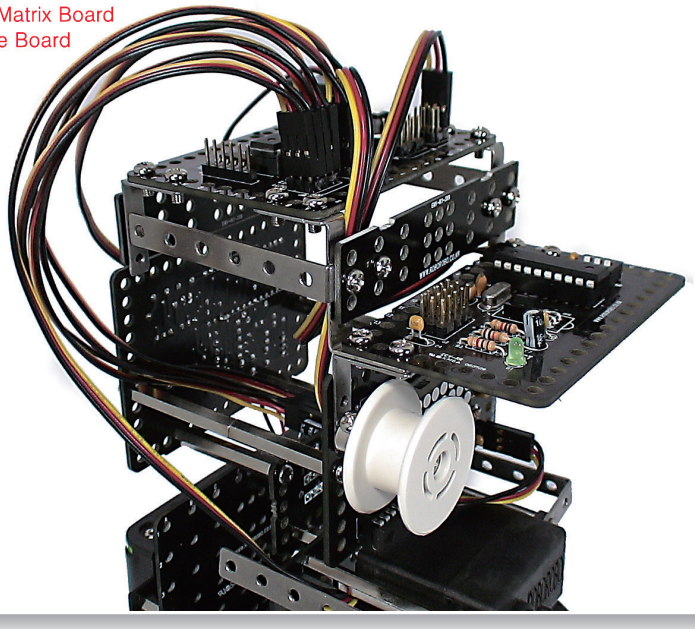
9 Connect the Middle Frame, Motor Frame, L-2x6 Frame to the CPU Board and make a cap.



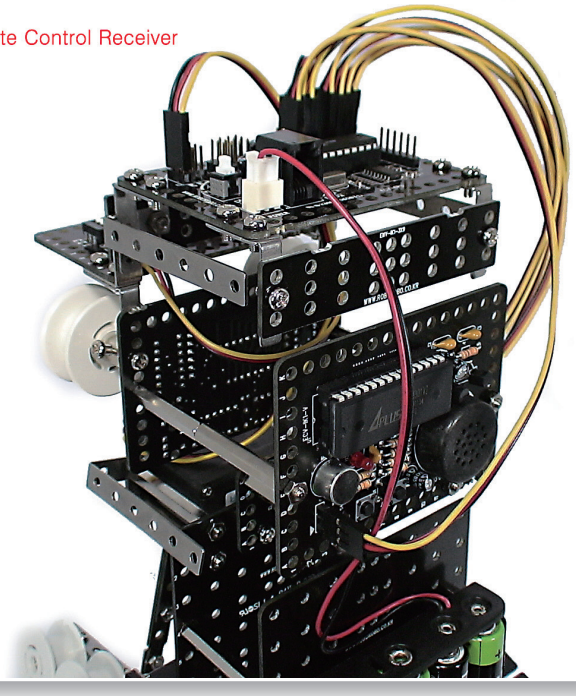


10 Refer to the both pictures taken from different angle.
A) Assemble in order of Middle Frame → L-2x6 Frame → Motor Frame. Use the first hole on top of the Motor Frame.

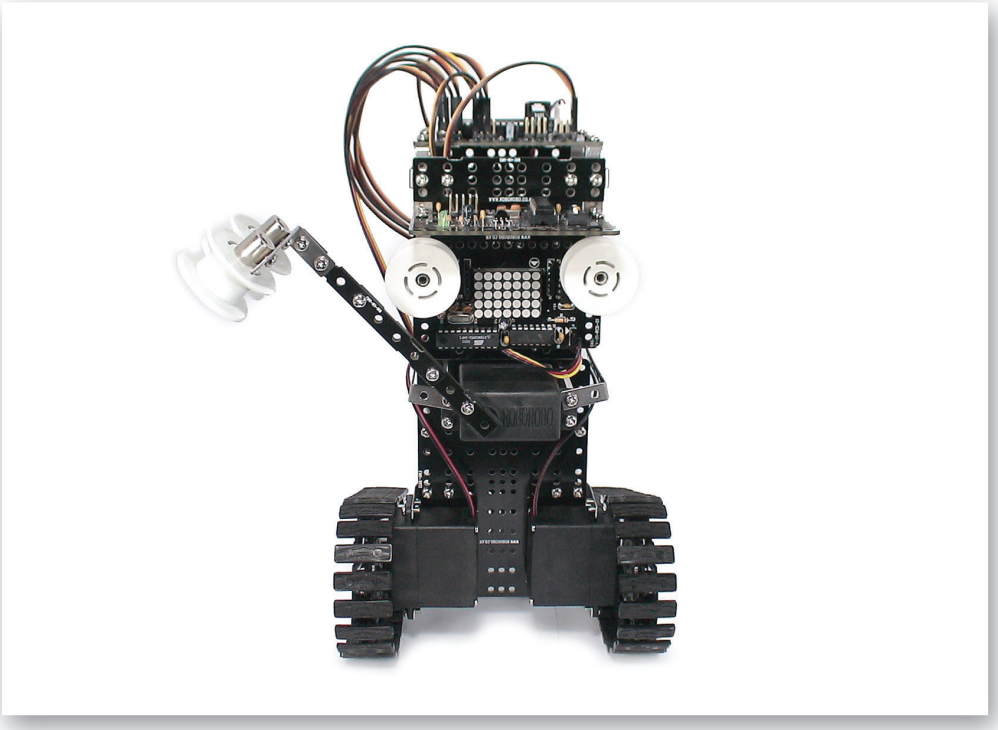
CPU Board
OUT 1~4 : DC Motor Drive Board 1~4
OUT 5 : Servo Motor
OUT 6 : Dot Matrix Board
OUT 7 : Voice Board

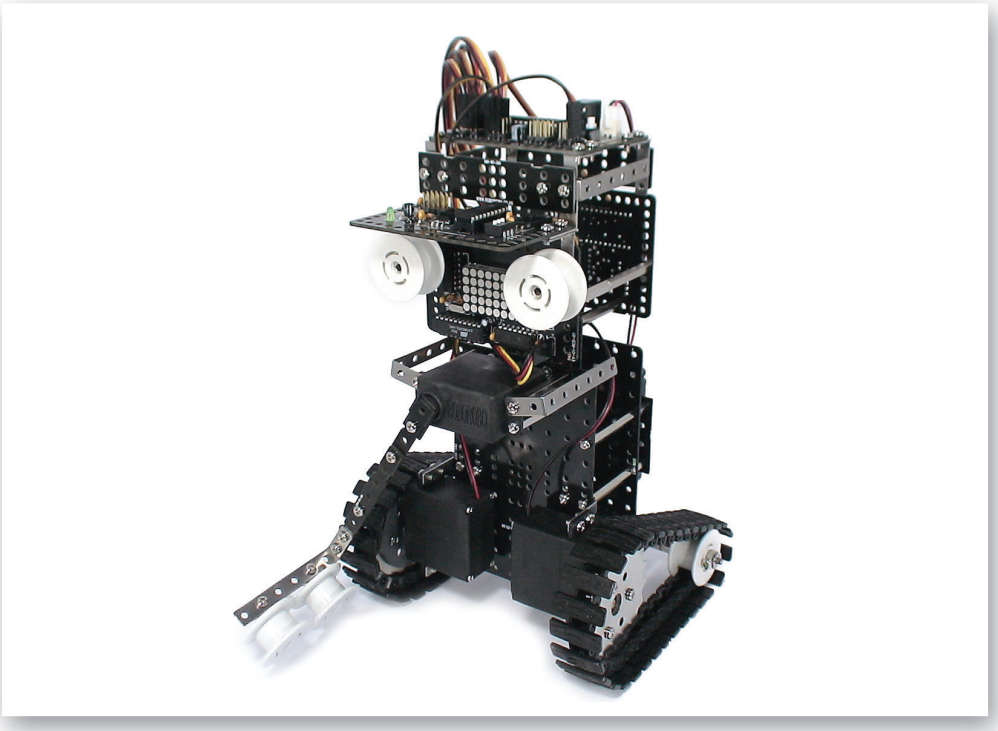


CPU Board
IN 7 : Remote Control Receiver

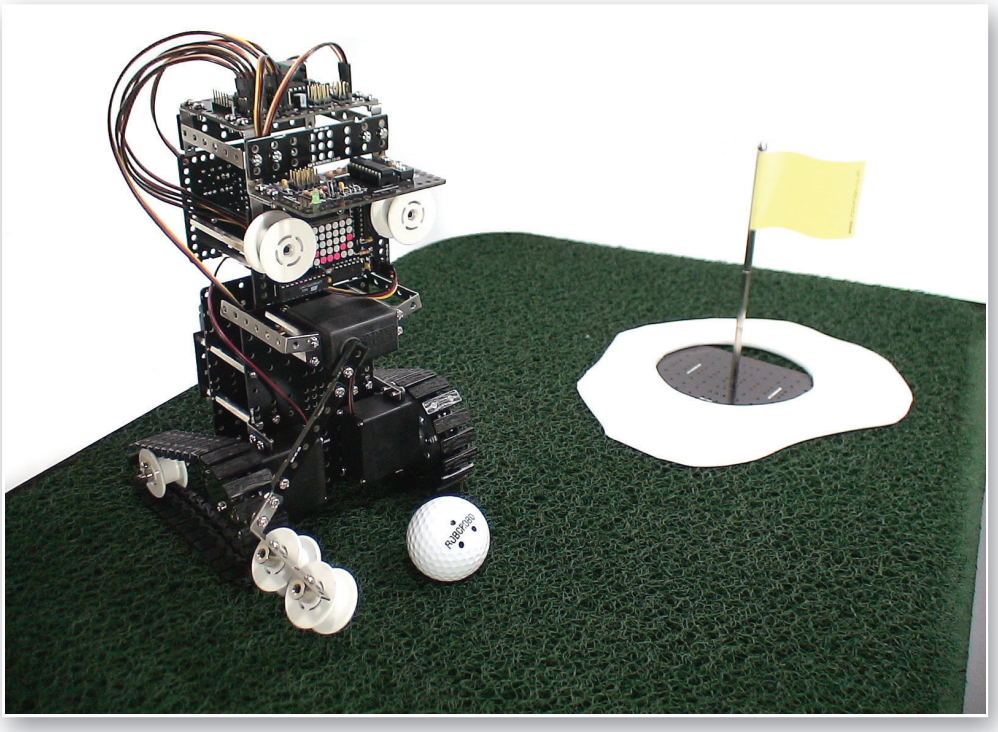


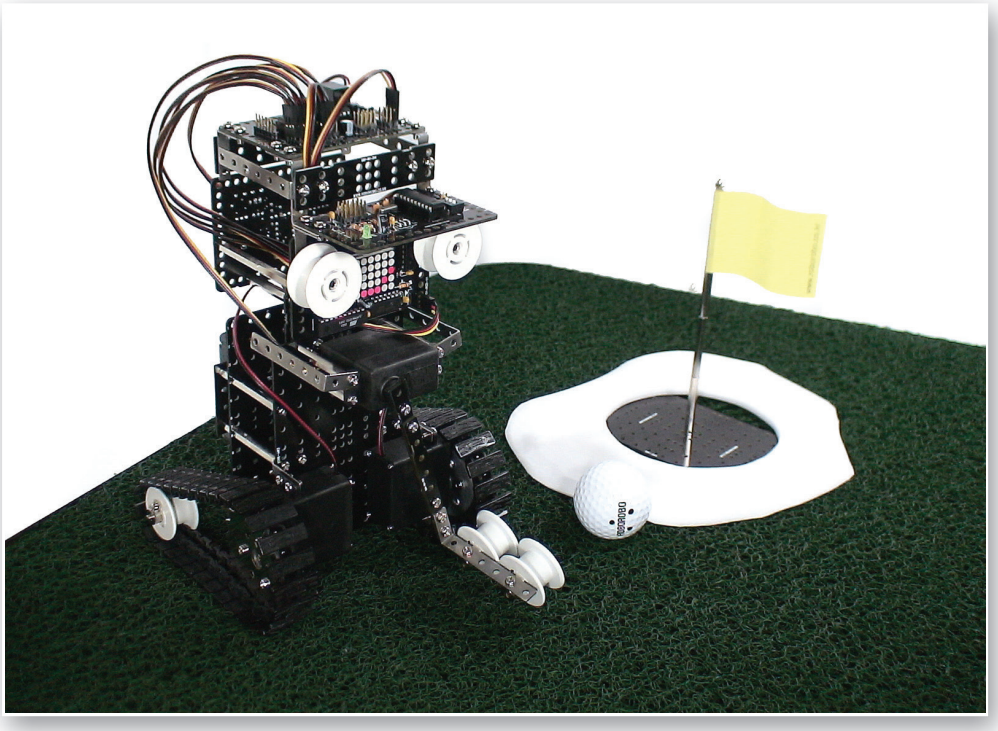
Completed GolfBot!





Let's Decorate!

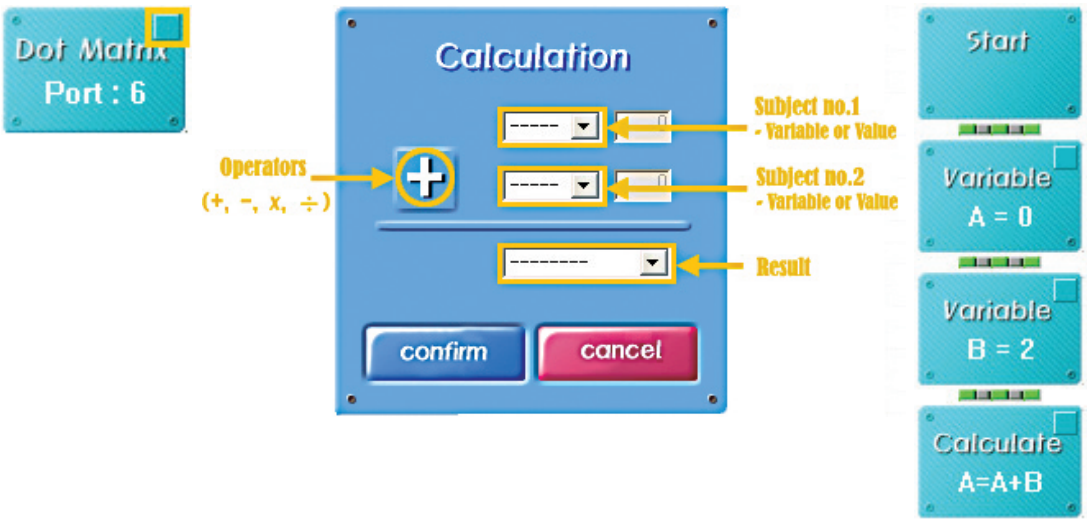




Calculate Chip

- Main Function : The Chip calculates a variable and a variable or a variable and a value.
- Application : Select the two values or variables and the operator (+-×÷) and then set the variable to save the result.

[Example]

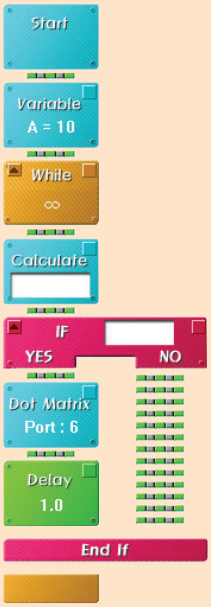


Practice!

Put the value in the Variable A, B. Set the arithmetic operator chip to add A and B and put its value to A again.

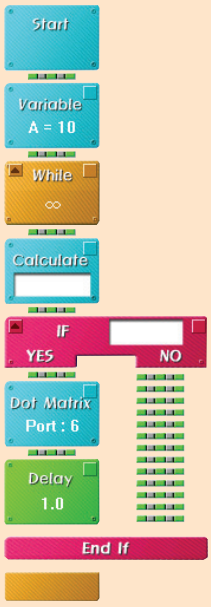
Practice!

If the result of adding the value of A and B is 5, show 5 on the Dot Matrix Board.



Practice!

Reduce the variable A 1 by 1. If A becomes 0, show 0 on the Dot Matrix Board.

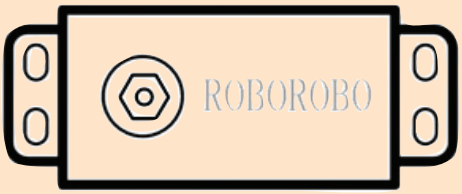


Set the Starting Point of Servo Motor

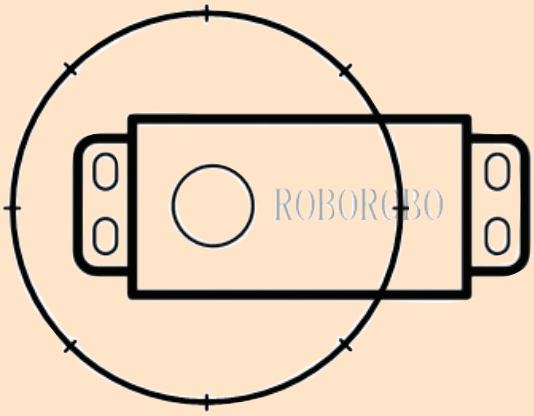
- Main Function : It sets the starting point and rotation radius of the Servo Motor.
- Application : Set the zero point and then fit the Motor Guide to the starting point. Then, Set the radius of rotation with the Servo Motor Chip.

Practice!

Draw the radius of rotation of the triangular hole and the Motor Guide.



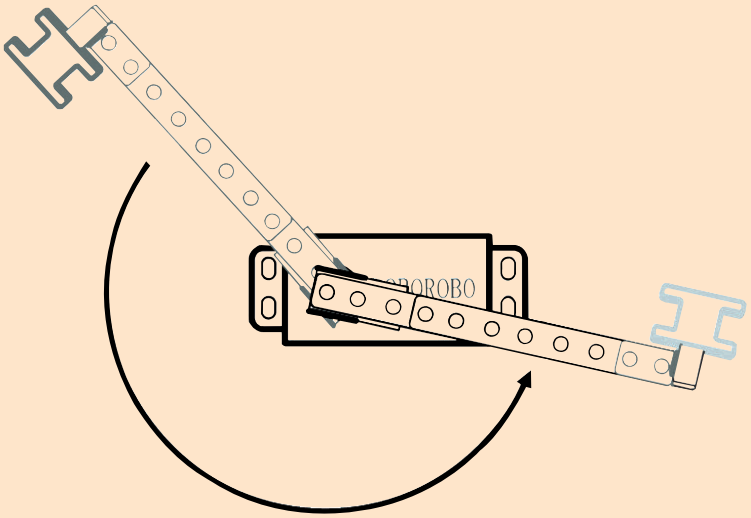
[Starting Point Set up Position]



[Radius of Rotation]

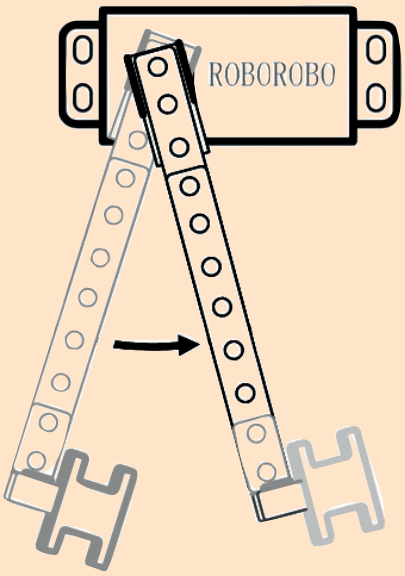
Practice!

Move the Servo Motor like the picture below to swing (Like swinging the golf club to hit the ball).



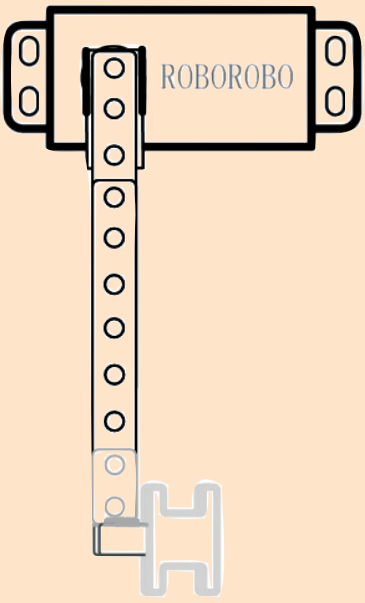
Practice!

Move the Servo Motor like the picture below to putt (Like rolling the ball with slight hit with a golf club).



Practice!

Move the Servo Motor like the picture below to pose to start.



Shall we make it move?

1 Make the robot move forward when pressing the button [1] of the Remote Control, move backward with button [2], turn left with [3] and turn right with button [4].

2 Plus the variable A and 1 by 1 when pressing the button [5], [1] together.

3 Make the robot pose for start, first. Then, raise a golf club a little when the variable A becomes 1 with the button [5], [1].

Why do we use Delay 0.2 seconds?

.....

.....

.....

4 Raise the golf club a little when the variable A becomes 1 with the button [5], [1], higher when the A becomes 2, and as higher as swing when it becomes 3. (Use the program of the question 3.)

Shall we make it move?

5 Record the dialog on the Voice Board to say something fun when swinging or putting.

6 Make the robot swing when pressing the button [5], [2] together and then make variable A become 0. At this time, let it play the record on the Voice Board.

7 Make the robot putt and then make the variable A become 0 when pressing the button [5], [3] of the Wireless Remote Control together.

8 Combine all programs to play the game.

Let's Play Game!

Putting Practice

1 Preparation

▶ Golf ball, Golf course including the hole

2 How to play

▶ It is a Game to hit a golf ball with a light stroke. Try to put the ball into the hole on the course.

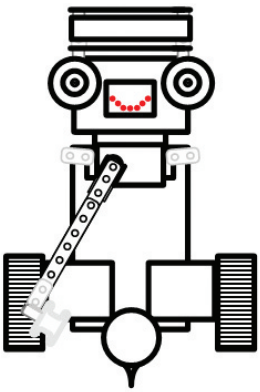
3 Game rule

▶ Player can putt only within the given chances.

▶ Player who puts the ball into the hole with the fewest strokes wins with the tournament.

▶ A ball should not be gotten off the course during the game.

4 Game Example



Hole in one

1 Preparation

- Golf ball, Golf course including the hole

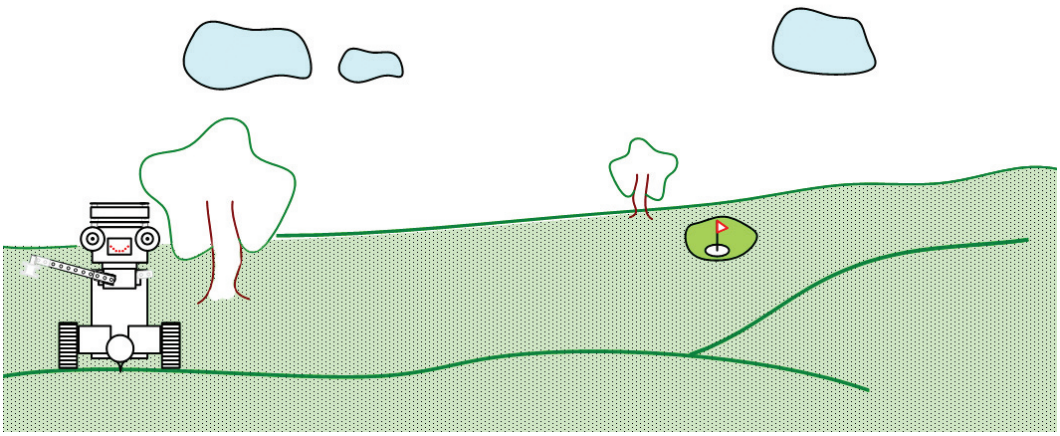
2 How to play

- Hole-in-one is when a player hits the ball directly from the tee into the cup with one shot. This is most possible on a par 3 hole. In golf, par is a predetermined number of strokes that a scratch (or 0 handicap) golfer should require to complete a hole, a round (the sum of the pars of the played holes), or a tournament (the sum of the pars of eachround).

3 Game rule

- Player employing the fewest number of strokes wins.
- Player has taken as many strokes as the hole's par number. If the game is Par 3, the players should put the ball into hole with three strokes.
- Bogey is one over par (+1).
- Birdie is one under par (-1).
- Hole-in-one is hitting the ball directly into the cup with one shot.

4 Game Example



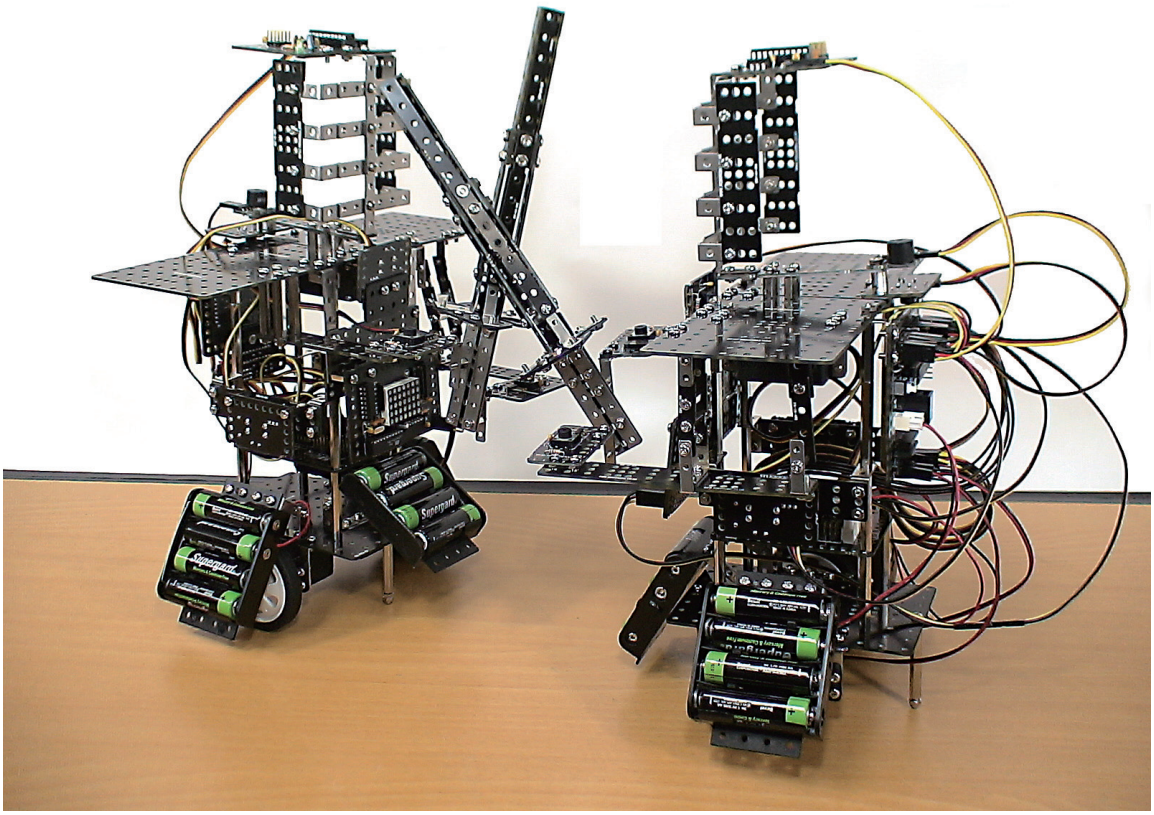
What did you learn?

1. While Susan was doing her homework, she deleted program chips by mistake. In the question below, if the results of △ and □ are 23 and 2 respectively, complete the program with the Variable Chip and Calculate Chip and show '^^' on the Dot Matrix Board.

Homework : 25x3−52=△
△+1=□
□÷12=□

Homework	Teacher 's Check

Today's Goal



KumdoBot is a kumdo robot that can practice fencing by hitting specified target areas connected to Contact Sensor Board. Set the While Chip on conditional repetition status which was endless repetition and let 's learn how to stop the robot when the Contact Sensor Board is pressed three times. Then, play the kumdo game by using the Contact Sensor as target area and the Dot Matrix Board as energy panel!

▶ Kumdo : The martial art of fencing with pliable bamboo staves or, sometimes, real swords: strict conventions are observed

▶ Specified target area : Parts of body (head, wrist, neck, waist) that can be count as score by hitting or stabbing

• • • Conditional Repetition • • •

〈Microwave oven〉

What do you associate with ' machine that heat foods within set up time '? Yes, you may immediately think of the Microwave oven which is easily found in the kitchen. A microwave oven, or a microwave, is a kitchen appliance that cooks or heats food by dielectric heating. This is accomplished by using microwave radiation to heat water and other polarized molecules within the food.

Well..have you ever used it before? Then, you know how to use it. If you press the cook time for two ~ three minutes or when pressing the 'cook the item' button, it works for a preprogrammed time and stops with ' beep ' sound. This is very convenient because it cooks and stops by itself in time. If you have to cook for 2 minutes on top of the stove, you should be stuck in cook counting the rest of time.

The function like the above timer can be applied to a washing machine when catching water. This smart function makes the washing machine dispense an optimal amount of water for the load.

What program do we need to make a robot that works continuously until it meets given conditions as above? You just need to apply the While Chip setting used for endless repetition.

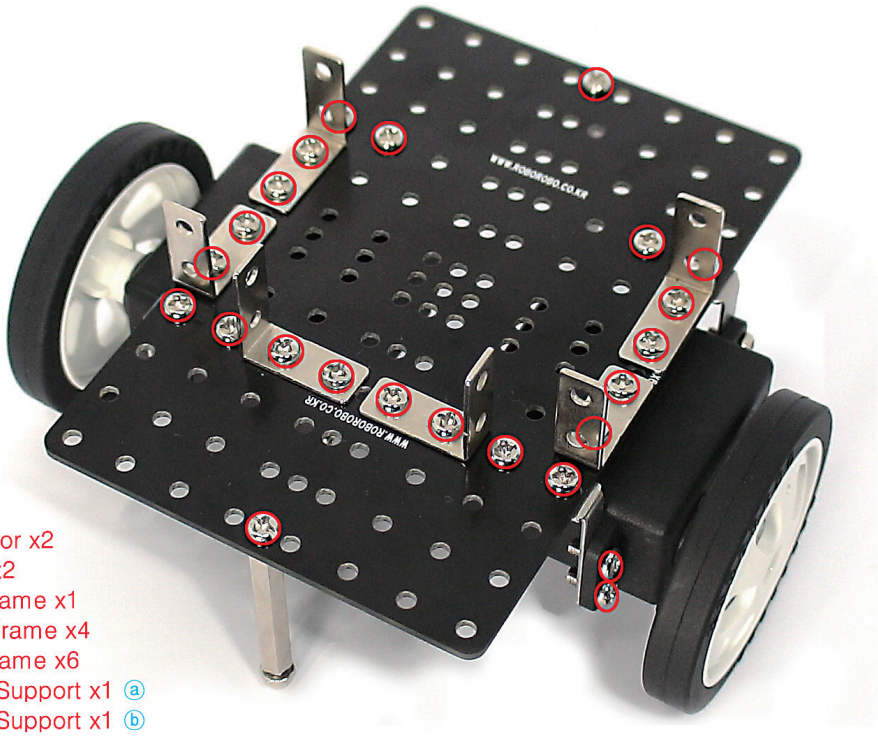
[figure 1] is program that proceeds using WHILE chip after adding 1 to the variance continually if the variance A is smaller than 3. It is the same principle that set the timer on the microwave for three minutes and it works for the time.

If so, when will the robot stop? It does not stop until 3 because it is set on the While Chip. As a result, it moves for 0.6 seconds.

〈Figure 1〉

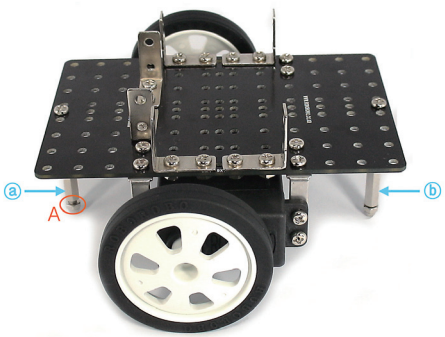
Reference
Samsung Electronics

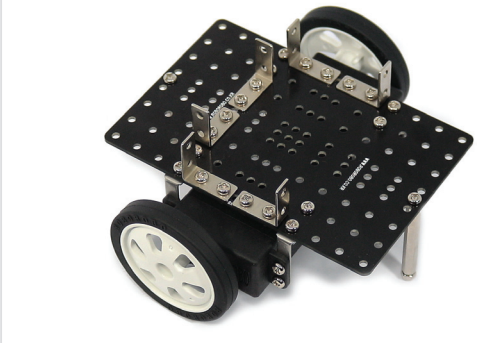
How to Assemble



DC Motor x2
Wheel x2
Main Frame x1
Motor Frame x4
L2x2 Frame x6
30mm Support x1 ⓐ
40mm Support x1 ⓑ
Cap Nut x2

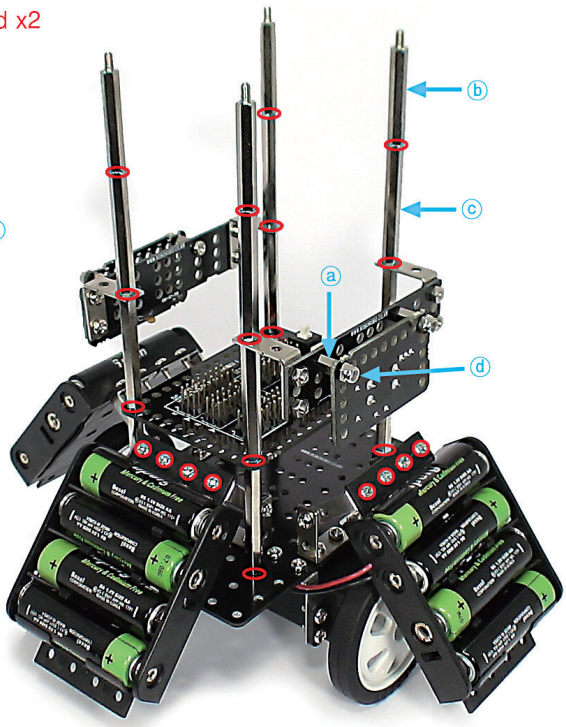
1 Fix the DC Motors to the Main Frame and then insert the Wheels. Fix the L-2x2 Frames and 40mm Support to the Main Frame.



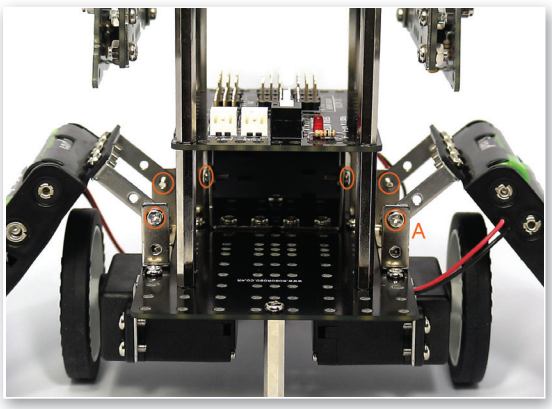


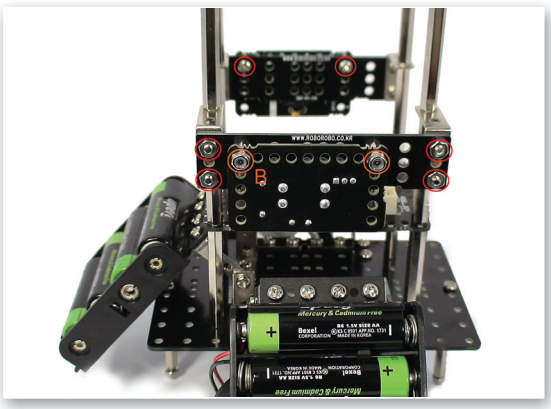
2 Refer to the both pictures taken from different angle.
A) Fix the 35mm Support and Cap Nut to keep the robot's balance.

Interface Board x1
Contact Sensor Board x2
Battery Case x3
Middle Frame x2
Motor Frame x6
L2x2 Frame x4
7mm Support x4 ⓐ
30mm Support x4 ⓑ
40mm Support x12 ⓒ
Nylon Nut x4 ⓓ



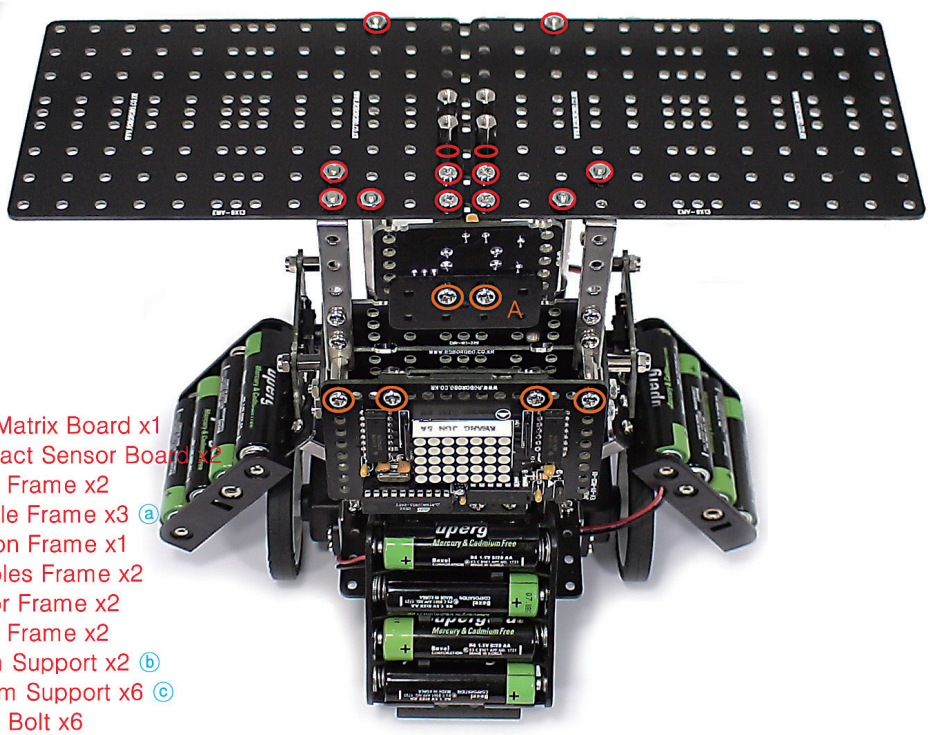
3 Fix the Interface Board, DC Motor Drive Board and Contact Sensor Board with various supports and then fix the Battery Case to the L-Frame that is connected to the Main Frame.





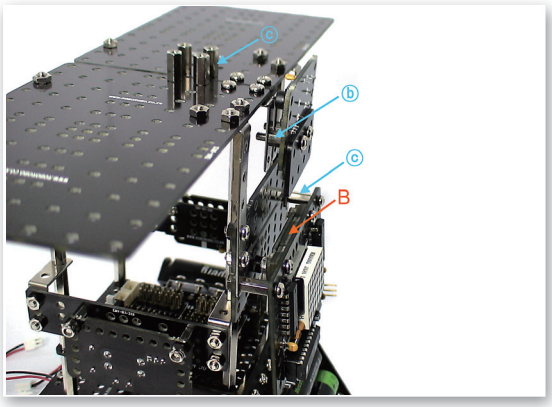
4 A) Fix the Nylon Nut as considering Contact Sensor Board to be detected when Middle Frame is pressed.
B) Fix the Motor Frame to inner area of L-Frame and fix the Battery Case with bolts as it does not touch wheels.

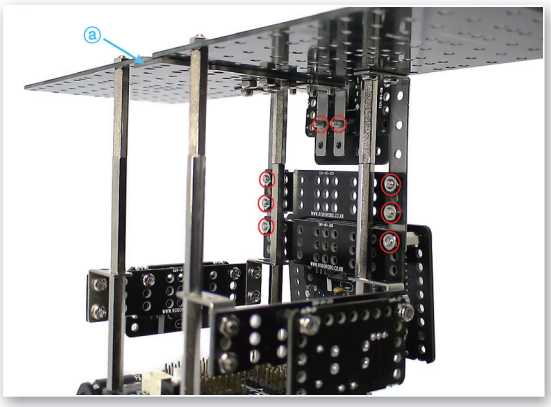
How to Assemble



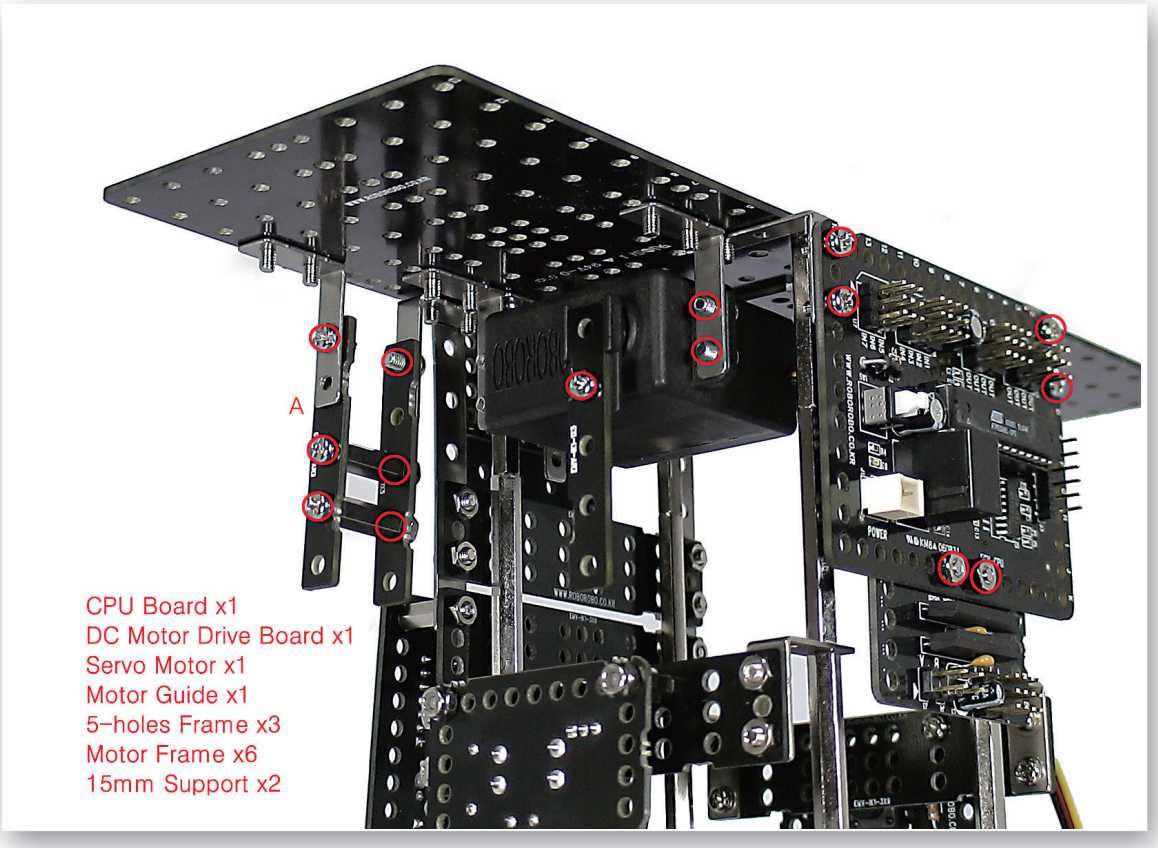
Dot Matrix Board x1
Contact Sensor Board x2
Main Frame x2
Middle Frame x3 ⓐ
Option Frame x1
5-holes Frame x2
Motor Frame x2
L2x6 Frame x2
7mm Support x2 ⓑ
10mm Support x6 ⓒ
3x10 Bolt x6

5 Fix the Dot Matrix Board, Contact Sensor Boards and Main Frames and make body.
A) There is still space between 3x10 Bolts and the Support even if 3x10 Bolt is tightened completely.

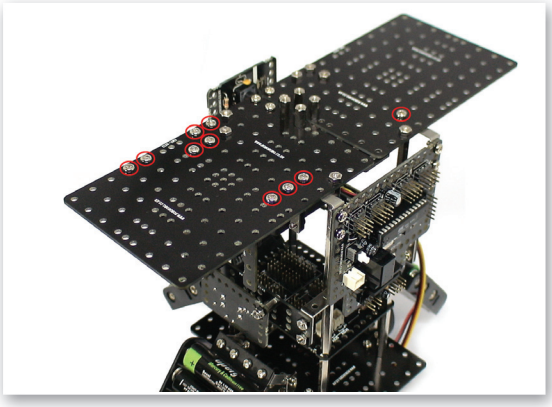


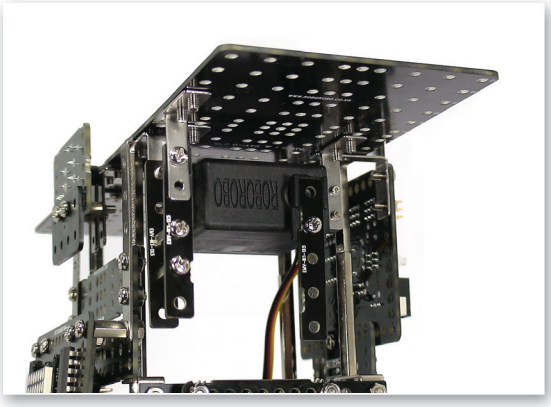


6 Refer to the both pictures taken from different angle.
A) Insert the overlapped two 5-Holes Fames to the back side of the Dot Matrix Board. Fix the contact sensor board by the 3x10 bolts as its back faces the Dot Matrix Board.

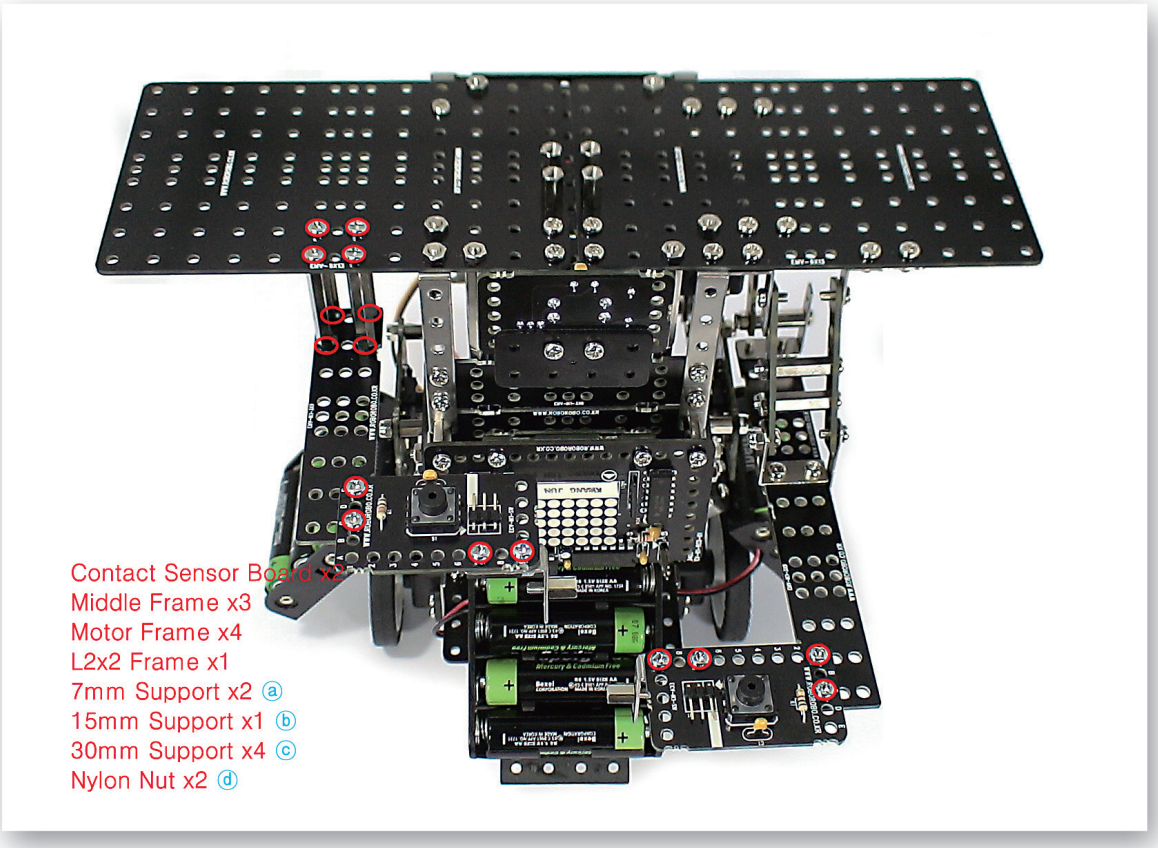


7 Fix the CPU Board, DC Motor Drive Board and Servo Motor to the Main Frame.
A) Tighten the 5-Holes Frame by bolts not to be separated due to motion.

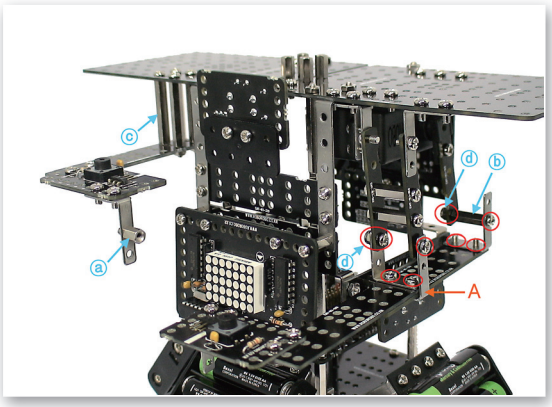


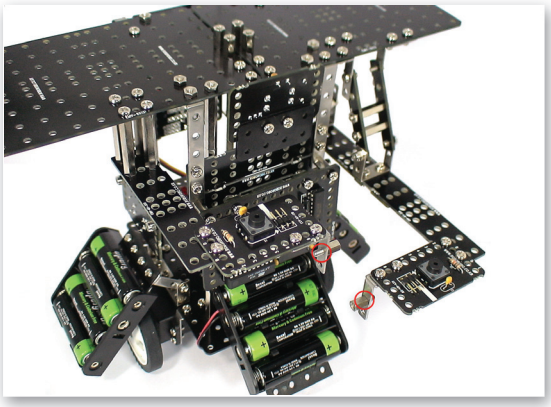


8 Refer to the both pictures taken from different angle.

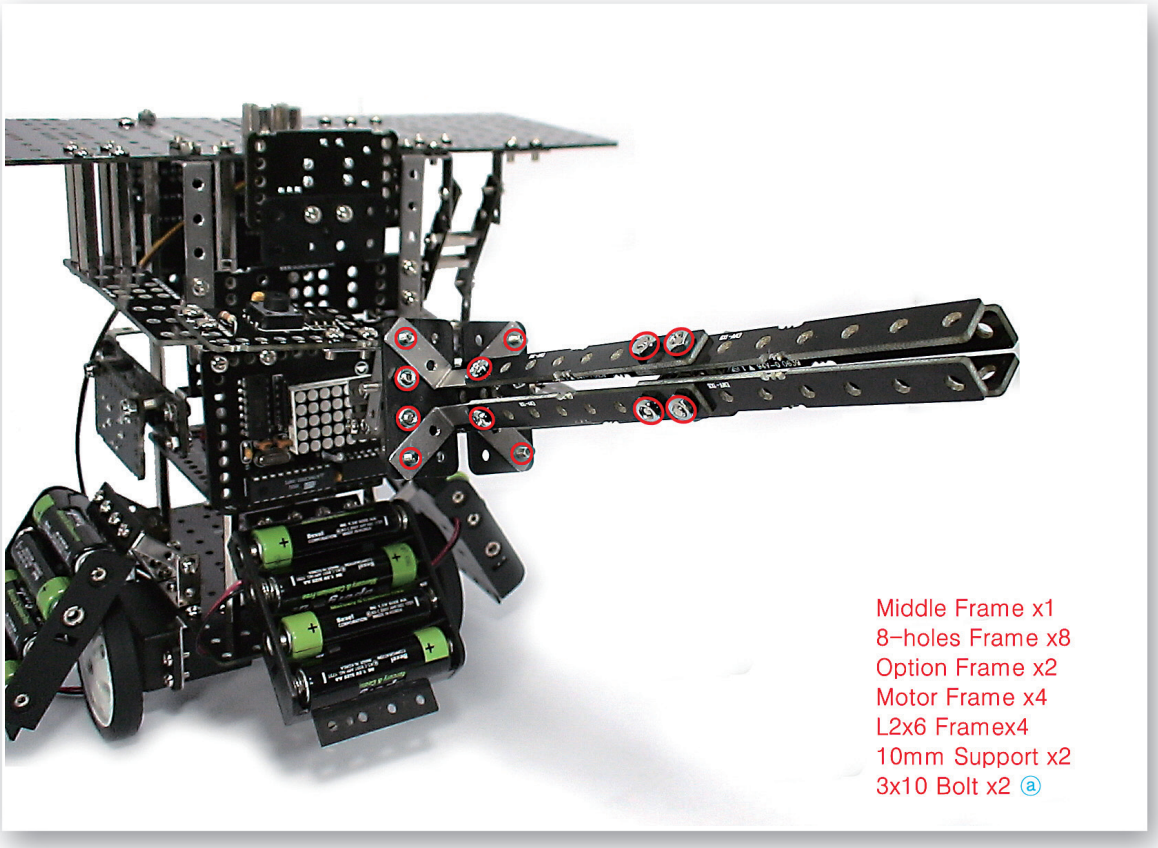


9 Connect the Contact Sensor Boards, Middle Frames and various Supports for both arms.

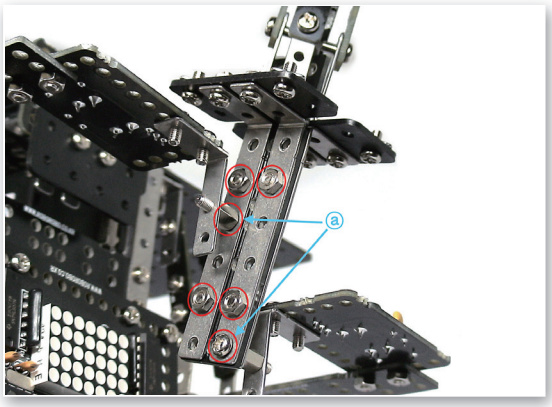


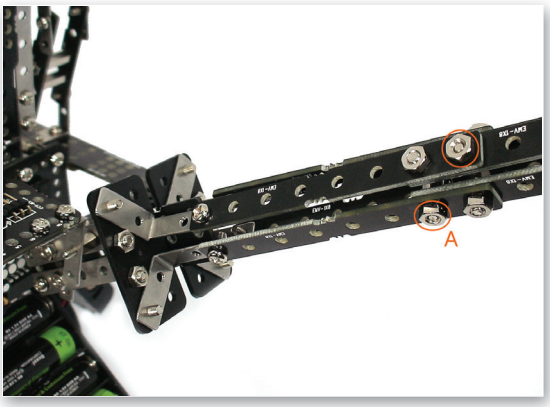


10 Refer to the both pictures taken from different angle.
A) Beware of overlapping order of two Middle Frames and assembled position of the Middle Frame between L-2x2 Frames and Motor Frames.



11 Use the 8-Holes Frames, L-2x6 Frames and various Frames and make a bamboo sword.

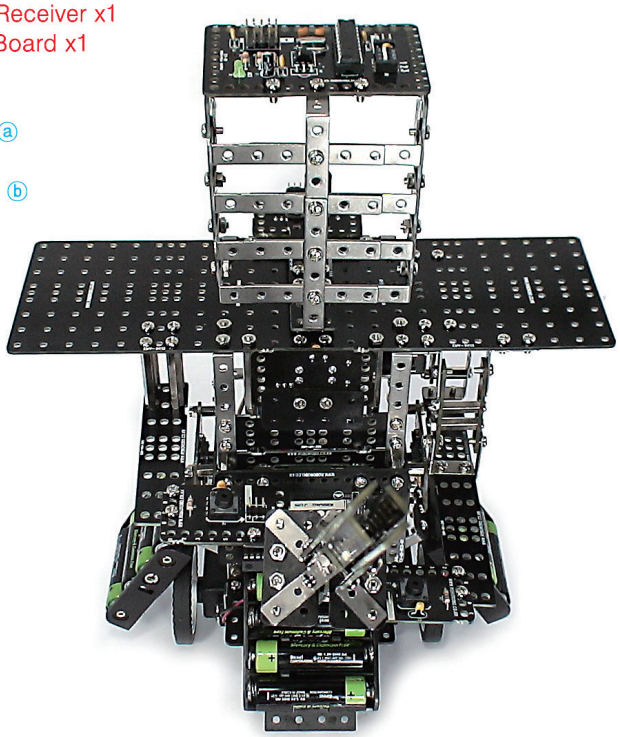




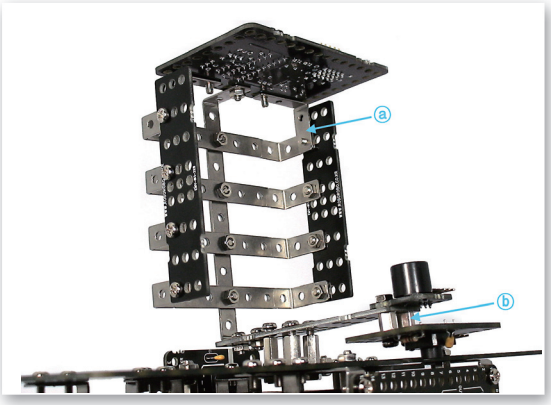
12 Refer to the both pictures taken from different angle.
A) Assemble two of 10mm Supports crossly in 8-Holes Frame to get connected to 8-Holes Frame across.

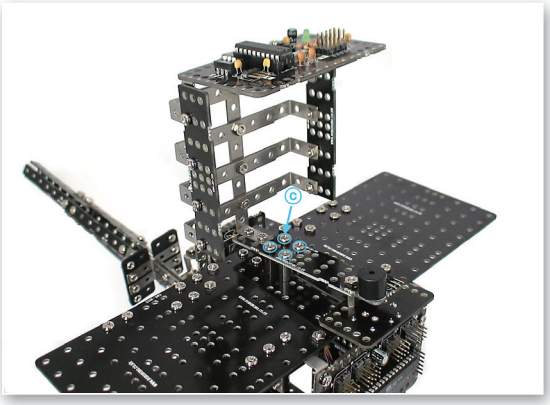
How to Assemble

Remote Control Receiver x1
Contact Sensor Board x1
Buzzer Board x1
Middle Frame x3
Motor Frame x2 ⓐ
L2x6 Frame x10
7mm Support x2 ⓑ
3x10 Bolt x4 ⓒ



13 Connect the Remote Control Receiver and L-2x6 Frames and make a kumdo mask (Men; equipment to protect face used in kumdo) and then fix the Contact Sensor Board and Buzzer Board.

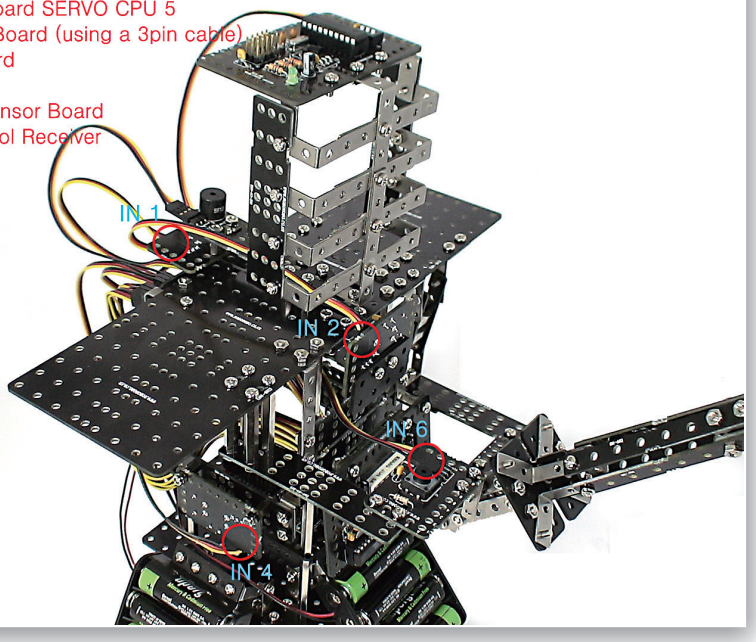


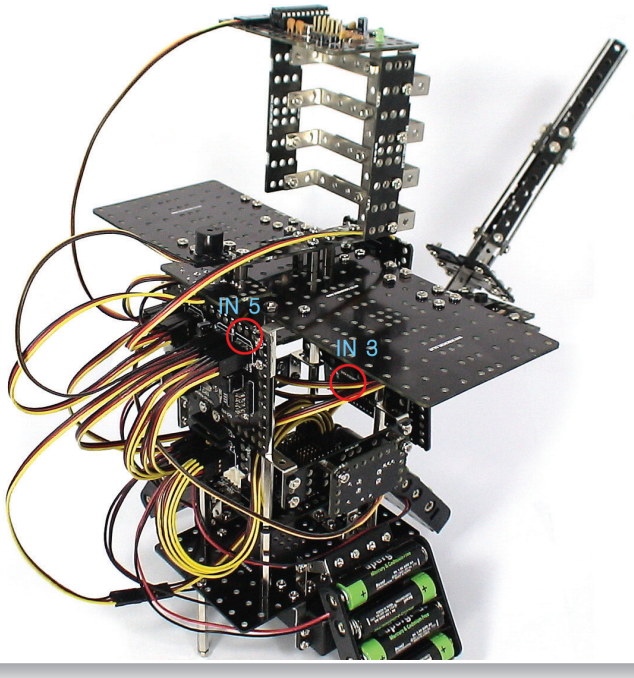


14 Refer to the both pictures taken from different angle.

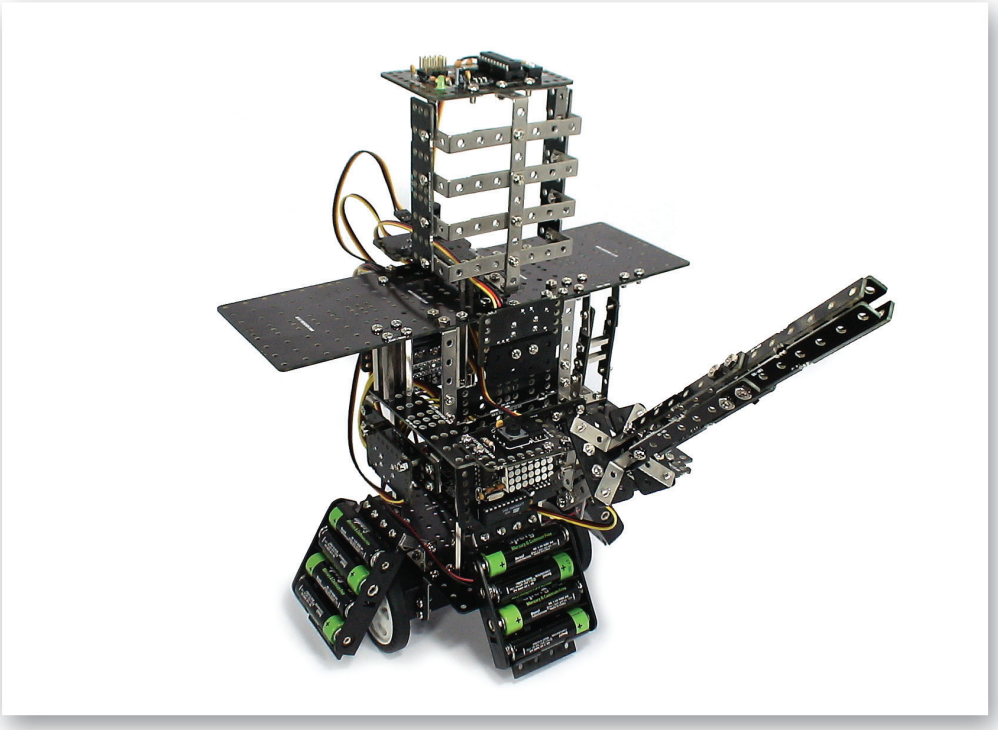
CPU Board
OUT 1~4 : Interface Board DC CPU 1~4
OUT 5 : Interface Board SERVO CPU 5
OUT 6 : Dot Matrix Board (using a 3pin cable)
OUT 7 : Buzzer Board

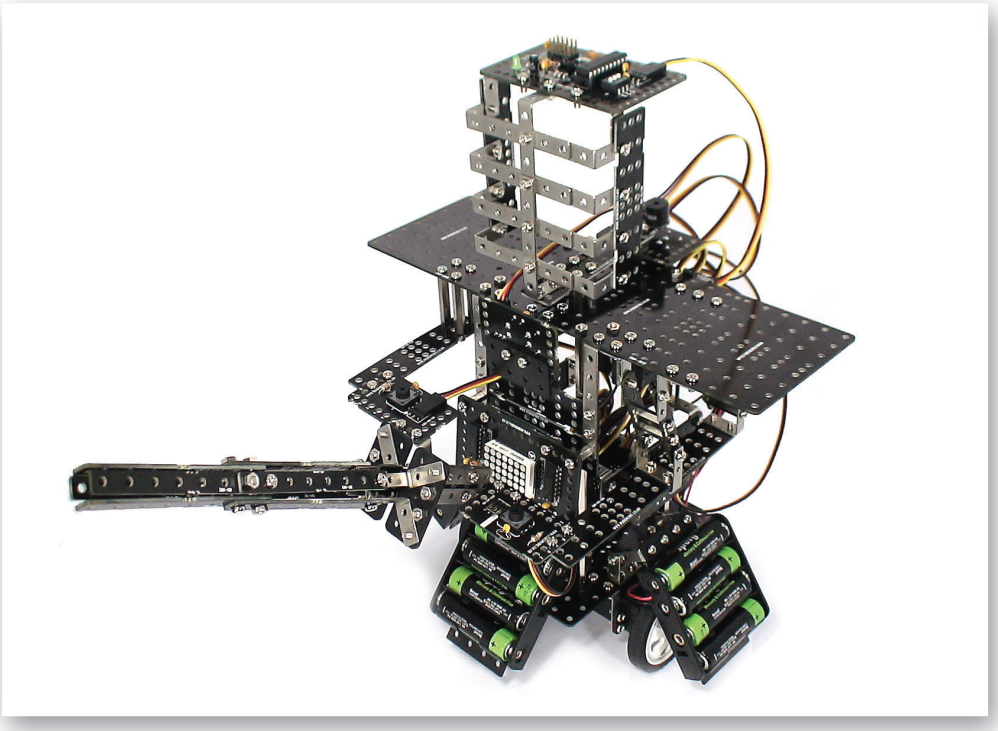
IN 1~6 : Contact Sensor Board
IN 7 : Remote Control Receiver

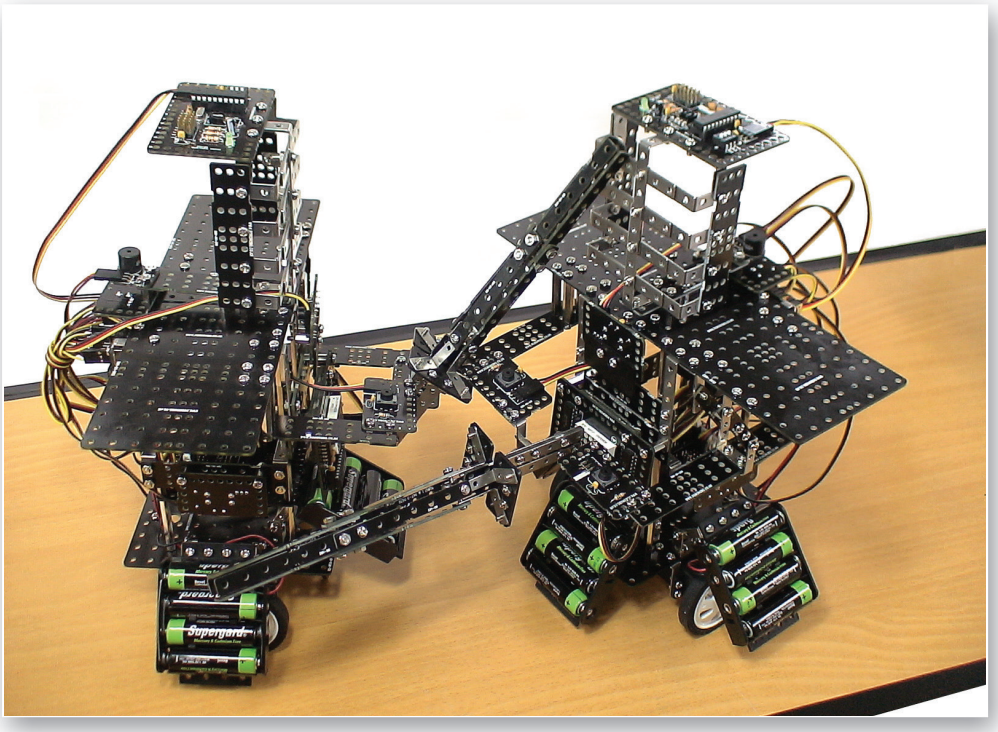


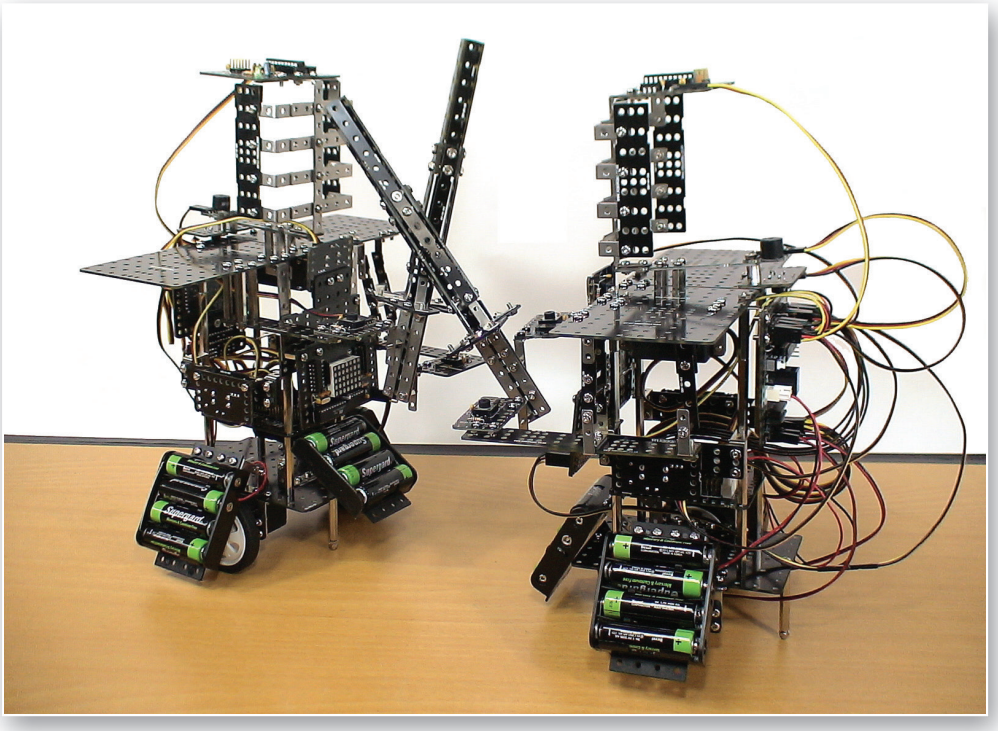


Completed KumdoBot!





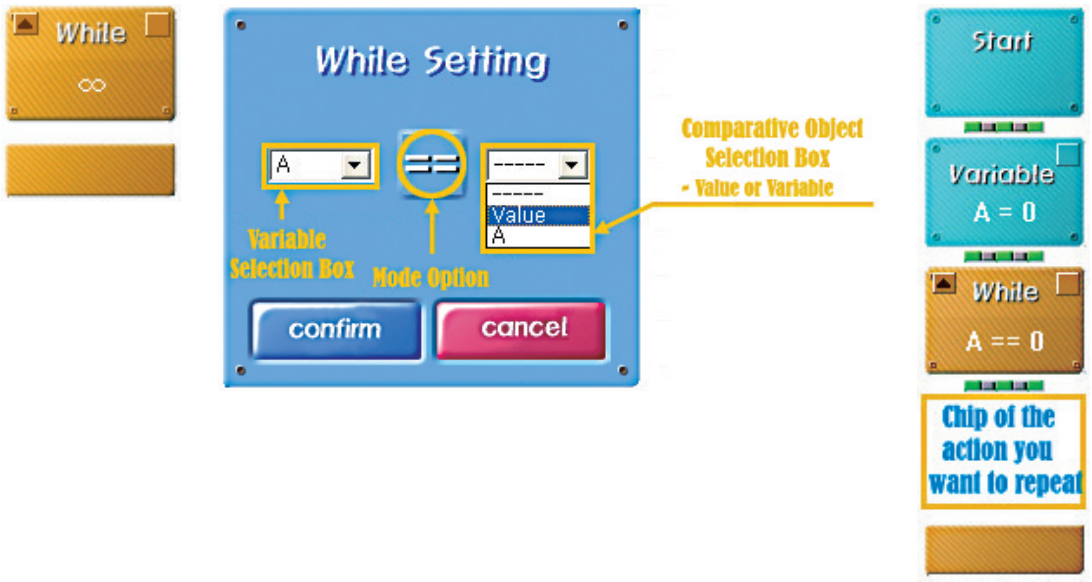




While Chip Conditional Repetition Mode

- Main Function : It repeatedly runs the program only if setting condition is true.
- Application : Select the value or variable to compare and the variable to compare and set the mode. Then, insert the chip that you want to repeat.

[Example]



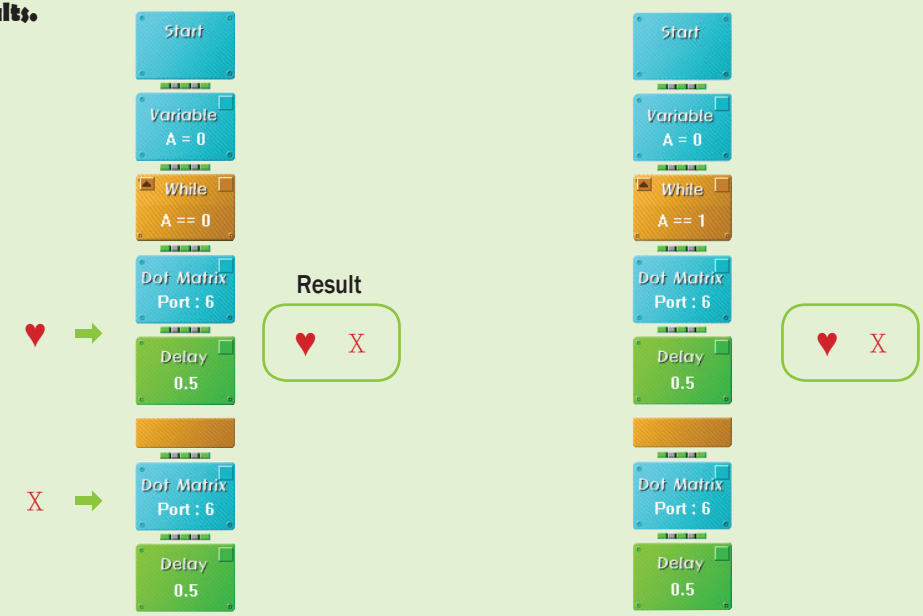
Practice!

Set the While Chip to meet the explanation condition below.

Repeat when Variable A is same as 3. 	Repeat when Variable A is bigger than 10. 
Repeat when Variable A is smaller than 5. 	Repeat when Variable A is smaller than 13 or the same. 
Repeat when Variable A is not 0. 	Repeat when Variable A is bigger than 7 or the same. 

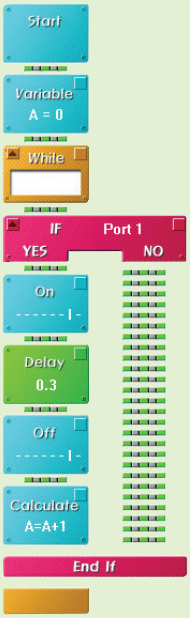
Practice!

Below two programs are only different in While Chip setting. Execute each program and mark the results.



Practice!

Set the While Chip to ring the buzzer only three times.

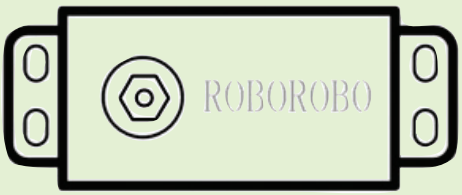


Set the Starting Point of the Servo Motor

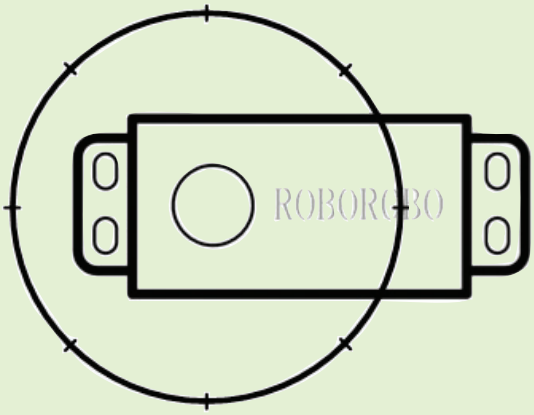
- Main Function : It sets the starting point and rotation radius of the Servo Motor.
- Application : Set the zero point and then fit the Motor Guide to the starting point. Then, Set the radius of rotation with the Servo Motor Chip.

Practice!

Draw Servo Motor axle and Motor Guide.



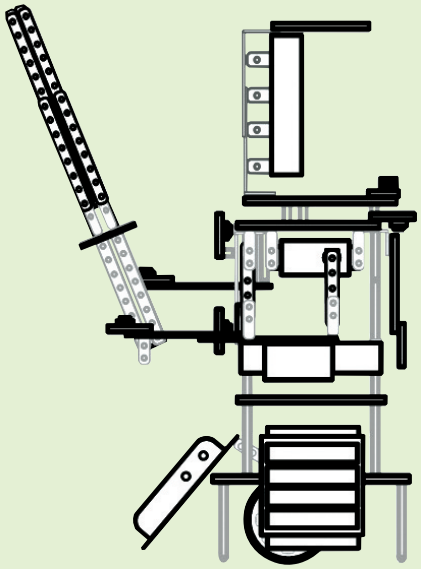
[Starting Point Set up Position]



[Radius of Rotation]

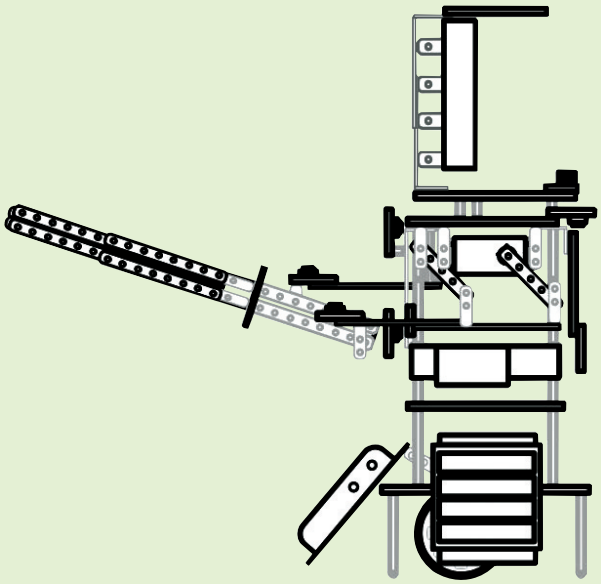
Practice!

Set the program to aim the bamboo sword at opponent's head.



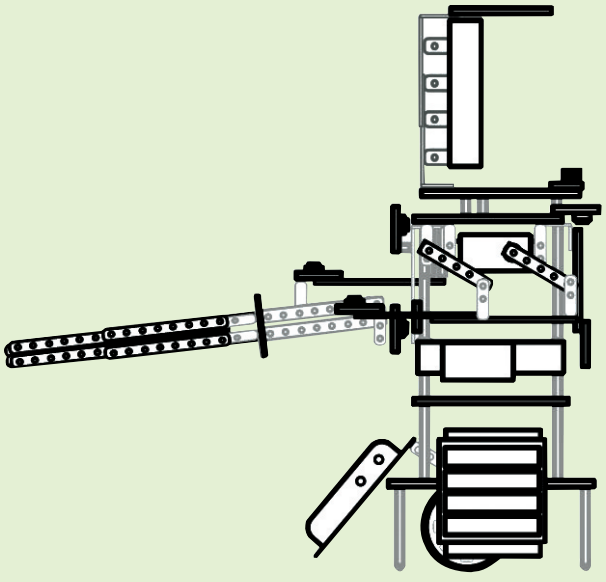
Practice!

Set the program to aim the bamboo sword at opponent's neck



Practice!

Set the program to aim the bamboo sword at opponent's chest.



Shall we make it move?

1 Make your robot move forward when pressing the button [1] of the Remote Control, move backward by button [2], turn left by [3] and turn right by button [4].

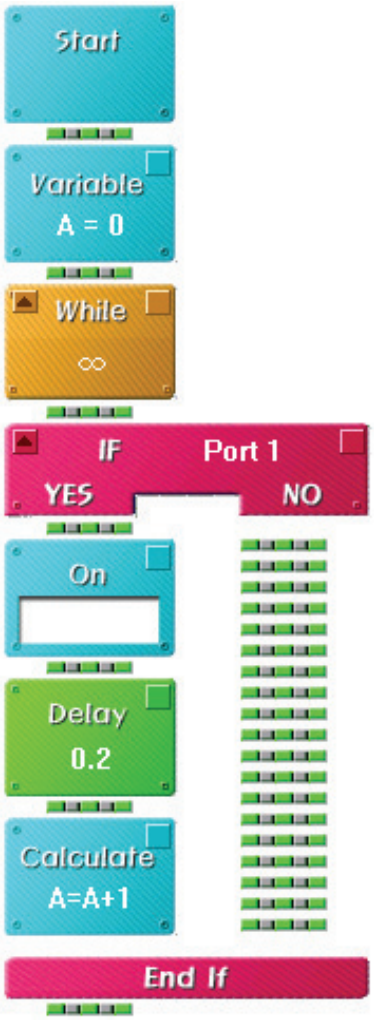
2 Make it hit the opponent's head when pressing the button [5], [1] together.

3 Make it stab the neck when pressing the button [5], [2] together.

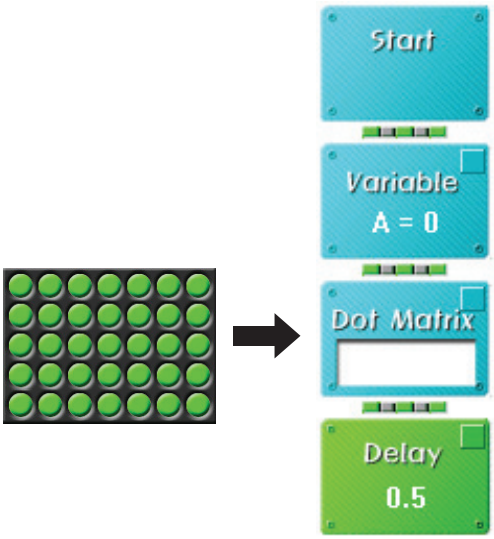
4 Make it stab the chest when pressing the button [5], [3] together.

Shall we make it move?

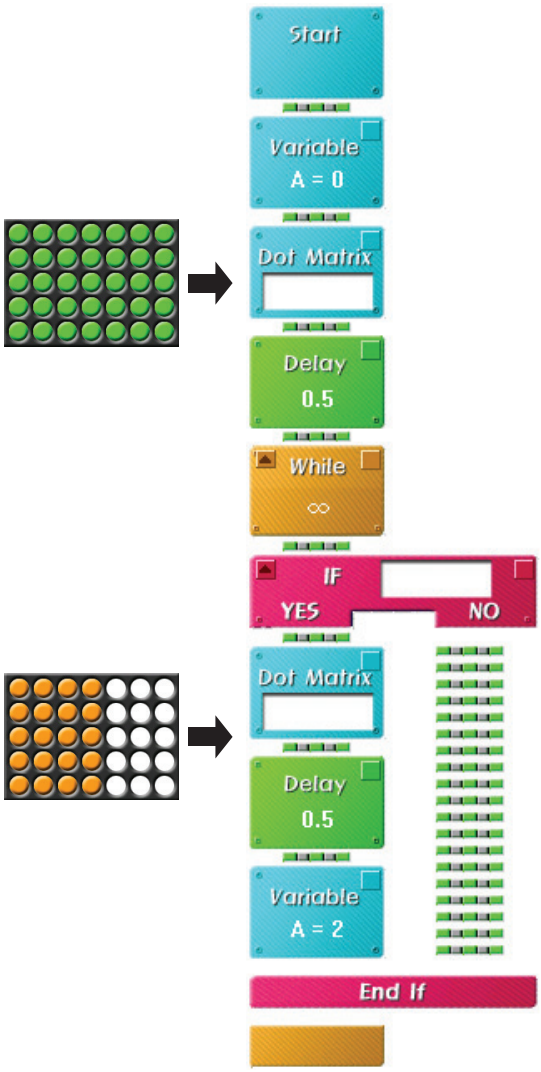
5 Make the buzzer ring if any of the six Contact Sensor Boards is attacked.



6 If the robot is turned on, make it appear like below on the Dot Matrix Board.



7 If Variable A is 1, make the program to appear like below on the Dot Matrix.



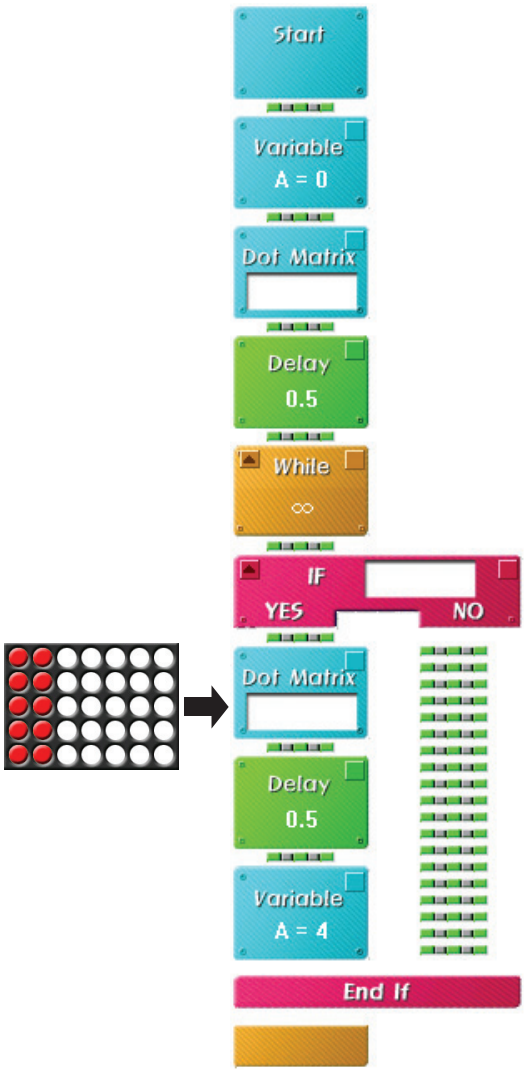
Why do we use ' Variable Chip A=2 '?

.....

.....

.....

8 If Variable A is 3, make the program to appear like below on the Dot Matrix.



Why do we use ' Variable Chip A=4 '?

.....

.....

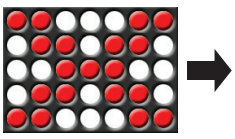
.....

Shall we make it move?

9 Through the programs of the question no.1~8, make the buzzer ring and Dot Matrix Board display the energy if the target area is attacked.

10 Set the While Chip in the conditional repetition mode and make the question 8 's program run only if A is smaller than 4.

11 If A becomes bigger than 4 in the program no.10, make the Dot Matrix Board display as below and Buzzer ring three times.



12 Combine all programs to play the game.

Let's Play Game!

Kumdo Game

1 How to play

▶Kumdo is a modern martial art of fencing. In a match, the competitors wear special protective gear and strike at each other's head, chest or hand with the bamboo sword.

2 Game Rule

▶Game starts with the sign of the referee after competitors bowing each other and poses to start.

▶Playing time is three minutes.

▶Player gains a point if striking one of a handful of targets with the sword before the opponent strikes yours.

▶Target area : head, neck, chest, wrists, left and right waists which are connected to the Contact Sensor Board.

▶Foul : ·When both wheels completely get out of the stadium

·When more than half of the robot gets out of the stadium when it fells

3 Score

▶If player strikes the target area accurately three times, gains three points and wins.

▶0.5 points is deducted for foul.

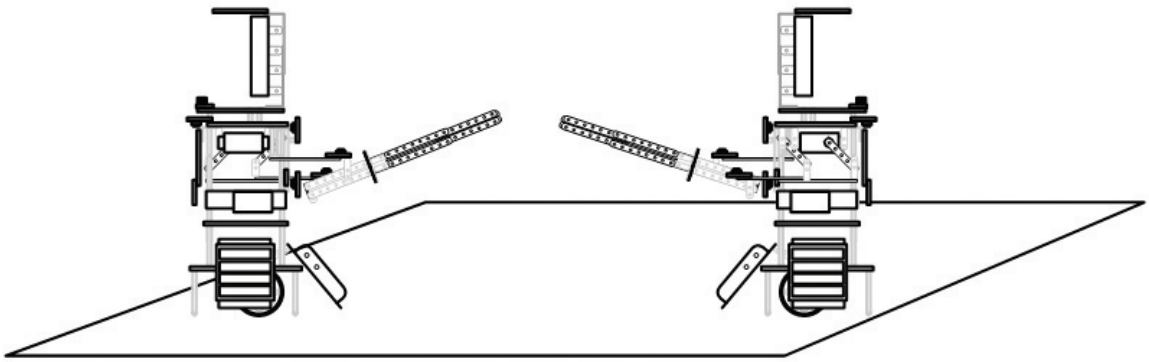
4 Other games

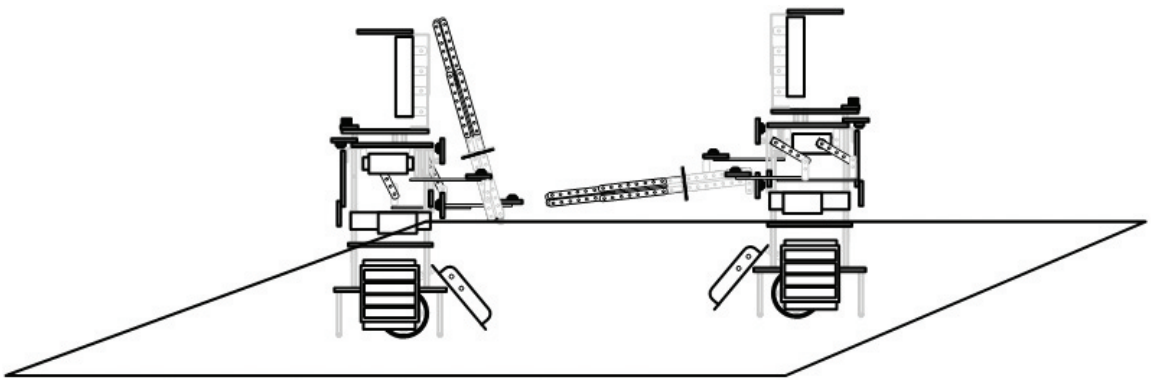
Players can play by team.

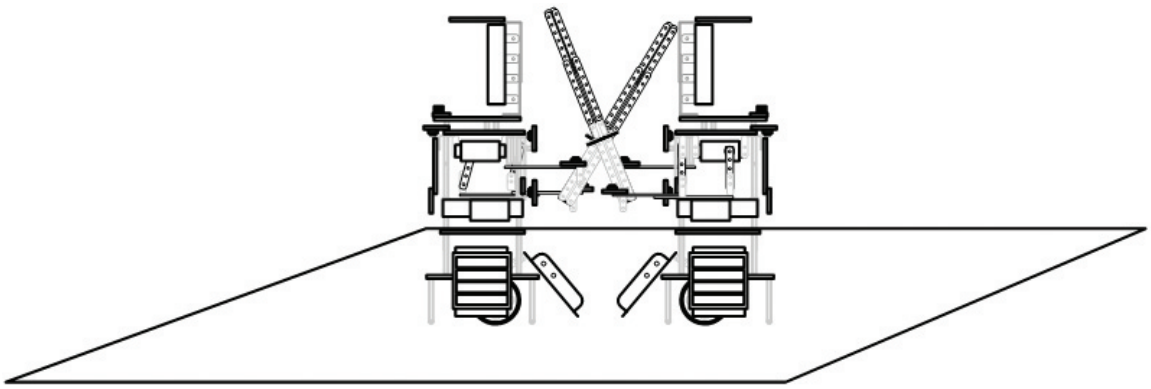
▶The Number of Winners method : The team who has more winners wins.

▶Winning streak method : The winner keep playing the game.

5 Game example

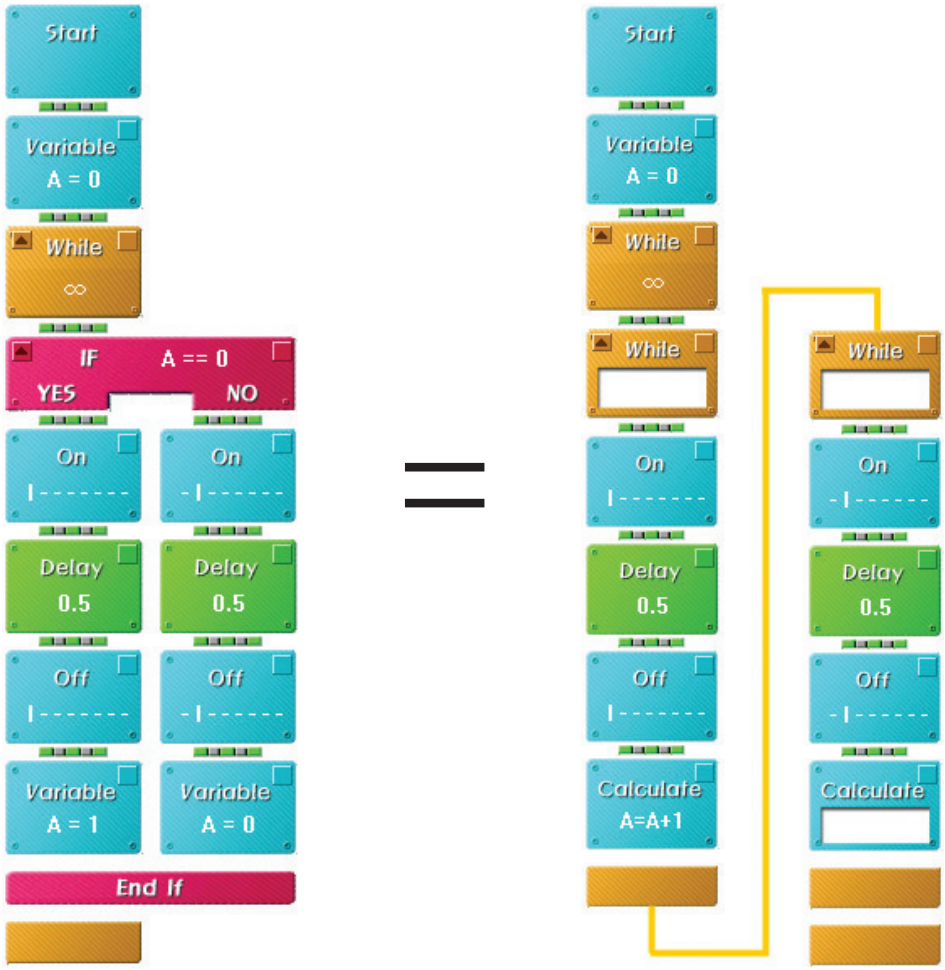






What did you learn?

1. Jenny made the left program that two LEDs blinks in order. She is trying to complete the right program by using Variable Chip, While Chip and Calculate Chip to make it to operate same as left. Fill in the empty blanks.



Homework	Teacher 's Check

Attach your BattleBot!

FutureBot is a self-created robot according to given topic. You can perform your abilities as practicing assembling methods and program chips that you have learned. Make your own robot with refreshing and creative idea that can help many people!

▶ future : time to come, time ahead
▶ idea : thought, concept

Separate Garbage Collection

〈Recycling bin〉

Suppose you live about 70 years-How much garbage will you release in life time? According to one research, it will be about 55 tons. Due to too much garbage, whole world is striving so hard to dispose of garbage.

People did not waste surrounding resources not so long ago. We fed food waste to livestock and used excreta for manure so we could reduce the garbage as small as our efforts. However, our life style has been changed as we have higher life standards. It's easy to point a finger at others or to lament about the environment damage caused by pollution or deforestation, but when it comes to lending a helping hand, most of us don't have the time, which is completely understandable. You may not be able to volunteer your services, but you can definitely do your bit to help.

〈Recycle Symbols〉

To solve garbage problem, first of all, you should reduce the amount of the garbage as much as you can. And you should start separate collection for recycling of resources. Separate garbage collection is to separately dispose of used paper, plastic, glass bottle, can, metal, furniture and clothes by categories.

How can we separate the garbage? Sometimes it is hard to know whether the garbage can be recycled or not. At this time, you can check the recycle symbols on the things. And otherwise you should separate the glass bottle according to color and remove the bottle cap.

Imagine the robot can separate and send out the recyclable waste. It must be very nice. Let's make a cool separate collection robot and show off your skills.

Quiz Time

1. Let's answer the below quiz in the television series ' Columbo '.

It was something like this: There are twelve bags, each bag containing a random number of gold coins. Eleven bags contain genuine gold coins, each genuine coin weighing one-ounce apiece. One bag contains counterfeit coins, each counterfeit coin weighing 9/10-ounces apiece. Using a scale to make only one measurement, how can you determine which bag is counterfeit?

You have as many bags as you please, (a minimum of two). You can have as many pieces of gold in the bags as you like and you can determine the weight of the coins as well, but the fake coins will weigh differently (more or less, it's up to you). You have a penny scale, meaning you can place something on a scale put a penny in and then receive a slip with the weight amount on it.

Reference
http://wiki.answers.com/Q/What_was_the_coin_riddle_Columbo_solved_in_the_episode_in_which_the_murder_occurred_in_a_MENSA_club