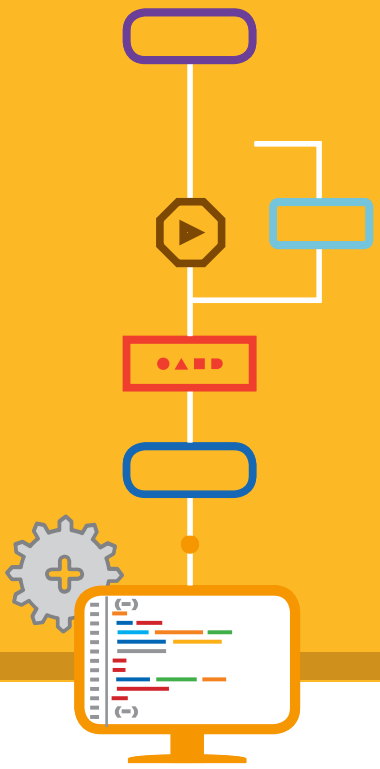
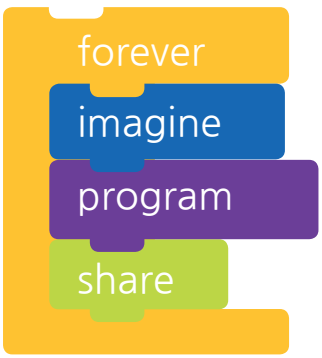
S C R A T C H C O D I N G K I T

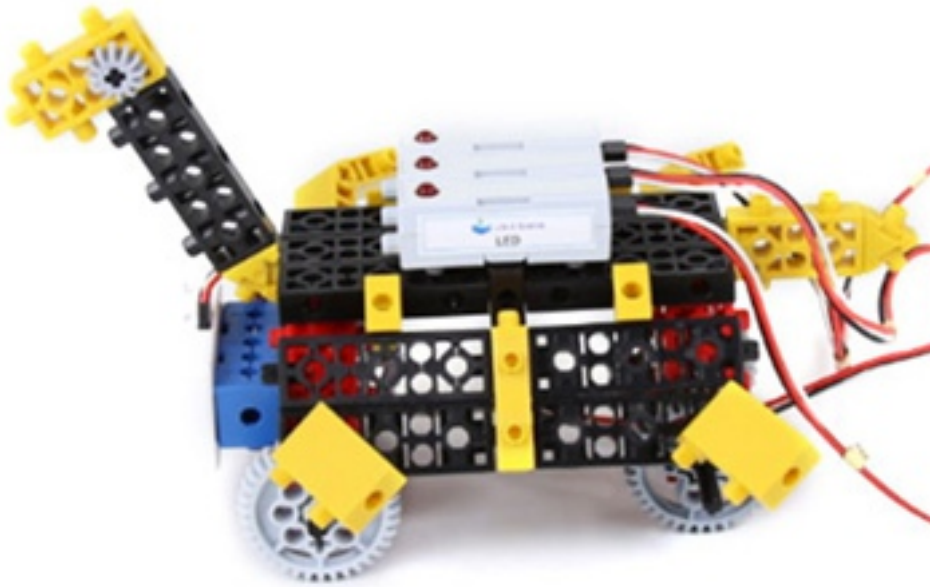
Logic boost

CODING CLASS

CLASS 3







Educational Toy

ROBOTORI

CLASS 3

Before getting started

The computer programmer is the creator of the universe, who is responsible for it. This allows infinite and complex forms of space to be created in the form of computer programs.

Joseph Bijenbaum

Contents

CLASS 3

To begin

Welcome to CLASS !

You know how to use products of ROBOTORI yesterday and what are the essential elements of programming concepts. In this book, we'll look at some of the more intensive programming steps you need to make more complex robots.

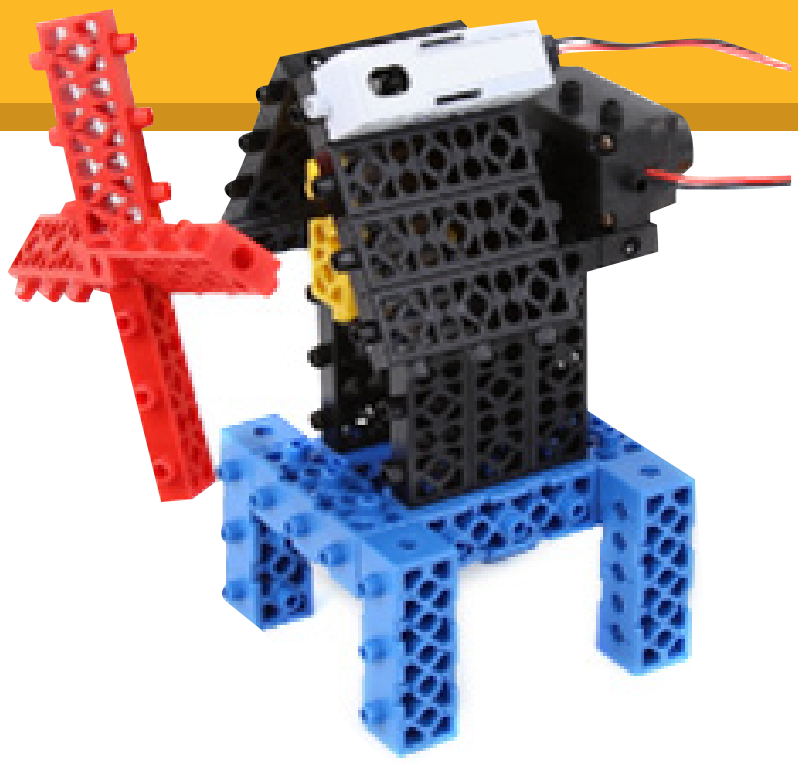
At this level, we will learn more advanced coding with IR sensors and ultrasonic sensors as input sensors.

SCRATCH CODING KIT

Logic Boost

Infrared Sensor
IR SENSOR

LESSON 1



CLASS 3

Sensor introduction

What is an infrared (IR) sensor?

In this lesson, you'll learn the input sensor, the infrared (IR) sensor.

We can use IR to detect an object and pass the detected value to the input value. It's similar to the brightness sensor you covered earlier.

When the infrared sensor is covered by your hand, the analog input value goes down, and when your hand is released, the analog input value goes up. It's the opposite of the brightness sensor. If the brightness sensor detects the brightness of the light, the infrared sensor measures the amount of light reflected.

Side

Front

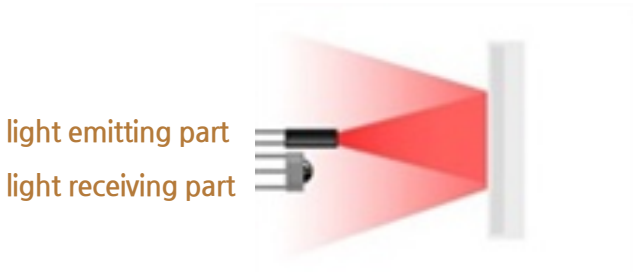
Find the sensor labeled "IR SENSOR" on the side of the Robotori product.

Let's see how infrared sensors work on the next page!

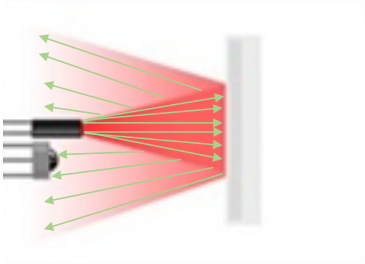
Sensor introduction

What is an infrared (IR) sensor?

The infrared sensor consists of two parts: a light emitting part and a light receiving part.

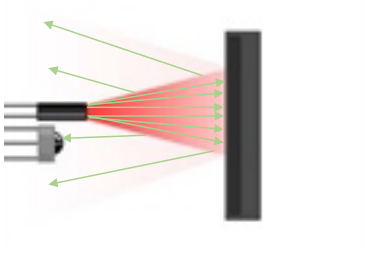


Infrared sensors detect objects by illuminating invisible infrared rays. It consists of a light emitting part that illuminates infrared rays and a light receiving part that detects reflected light. The amount of light reflected is different for each object. If an object reflects a lot of light, the light-receiving part will detect it as a bright object.



An object with a white color reflects a lot of light again. The receiver recognizes a lot of light and judges that this object reflects a lot of light.

If the object is dark, the light will be absorbed by the object and the light-sensing part will perceive it as a dark object.



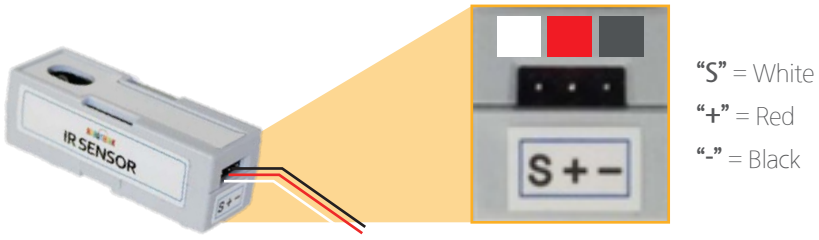
Dark objects rarely reflect light. The receiver recognizes that there is little light, and judges that this object is dark.

CLASS 3

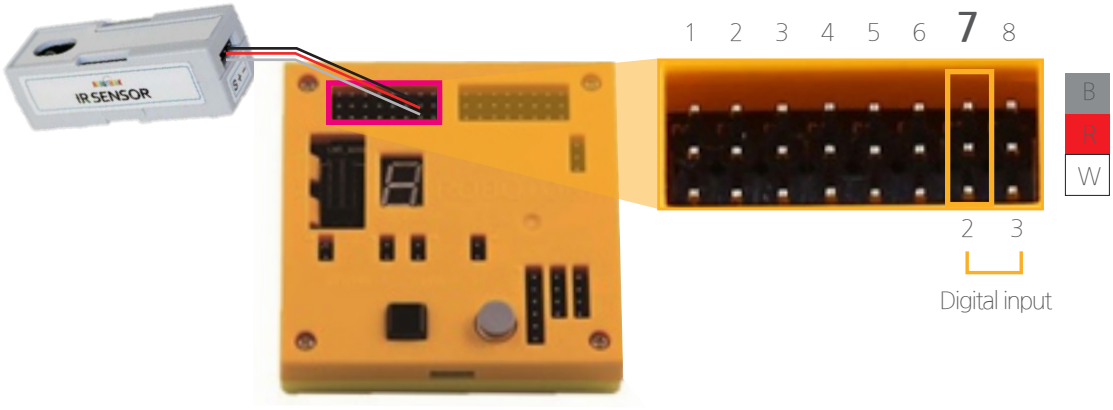
Connecting Main Cell

Connecting IR sensor

Now we will connect the infrared sensor to the main cell. Plug the 3-pin connection jack into the infrared sensor as shown below.



Please check that the sensor does not work if you do not connect it correctly according to the cable color as shown above. Attach the sensor to slot 7 of the board.

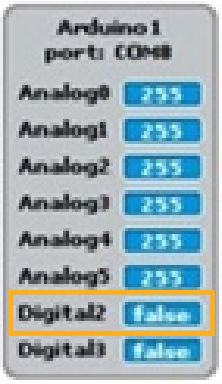


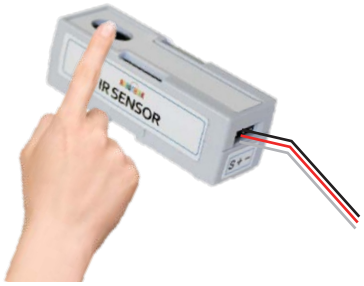
Infrared (IR) Sensor Coding Experience

Using IR sensor

Now, let's turn on the main cell, go scratch and see how the sensor gives us information.
If everything is connected properly, cover the infrared sensor with your hands and remove it.

If the infrared sensor is still present, "Digital2" will be 'false'.





If the infrared sensor is covered by your finger, "Digital2" will be 'true'.

If Digital2 is true, there is light reflection, and if Digital2 is false, there is no light reflection.

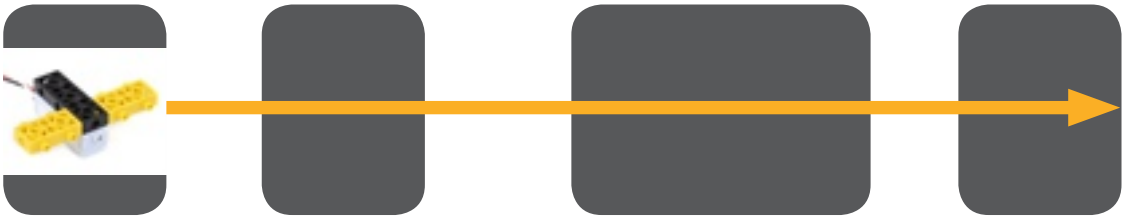
CLASS 3

Infrared (IR) Sensor Coding Experience

Using IR sensor

Connect the infrared sensor cell as shown in the figure below.

Slowly pull the infrared sensor along the pattern below. Then write it in the blank, whether the sensor is true or false.



false

Infrared (IR) Sensor Coding Experience

Using IR sensor

Now I'll see how you can apply an infrared sensor to your program. First, we have to make our old friend, a mini windmill. Now you can make this model very quickly.

Windmill Materials

								
Diamond V8 x 2	Diamond V6 x 6	Rubi 8 x 4	Rubi 7 x 2	Rubi 6 x 2	Rubi 4 x 8	Rubi 2 x 5	Rubi 0 x 1	Mini 2 x 1
								
Mini 1 x 1	Triangle x 3	Motor connector x 1	A 96 x 1	DC Motor x 1	Battery Case x 1	Main board 128 x 1	IR sensor x 1	connector x 2

CLASS 3

Infrared (IR) Sensor Coding Experience

Using an infrared sensor with a mini windmill

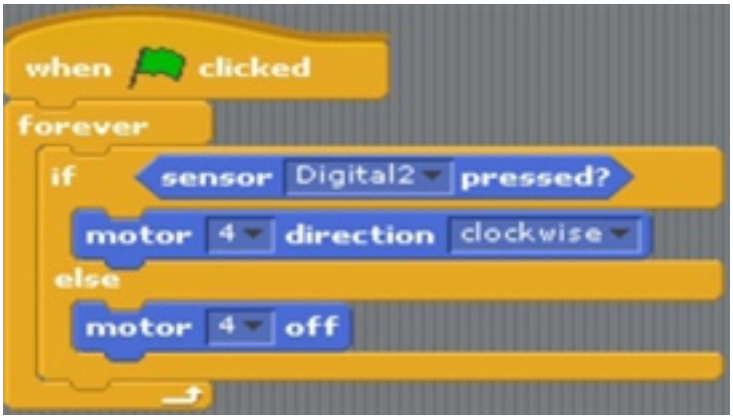
We will use the infrared sensor to operate the mini windmill. First, we need a way to get the "true" and "false" values of an infrared sensor with scratches. To do this, go to the Motion tab and import the "Sensor digital 2 pressed" block into the script as shown below.

Infrared (IR) Sensor Coding Experience

Coding a mini windmill with an infrared sensor

Just as you learned with the button sensor, you can see that the digital value is 'true' when the infrared sensor is covered and the digital value is 'false' when it is off.

Now, let's see how to operate the motor using an infrared sensor instead of a button sensor. Plug the DC motor into the 'Motore4' port on the main board.



Create a script like the one above. When you run the above script, you can see that the DC motor works when the infrared sensor is covered. You've learned a total of four input sensors so far. Let's try to simplify the digital and analog values for these sensors.

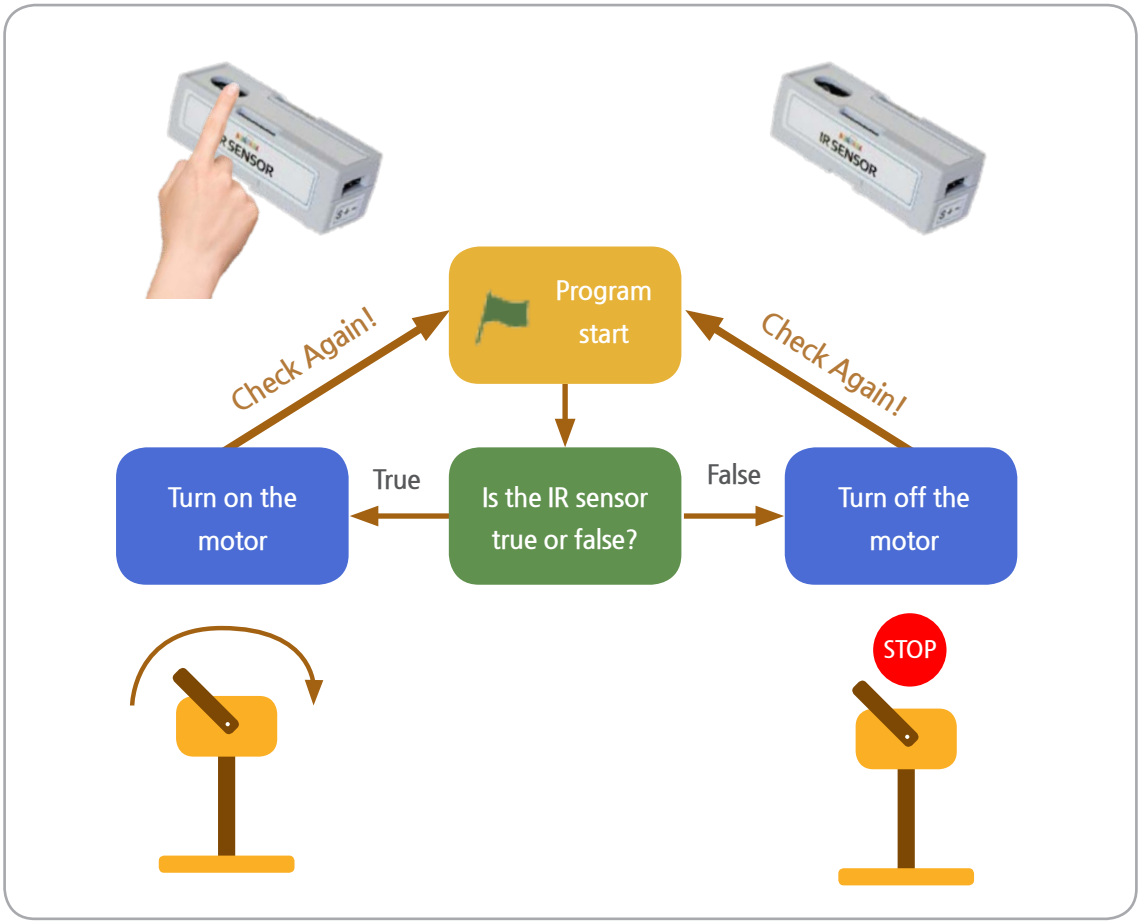
input sensor	input signal	Analog value	Digital value
BUTTON SENSOR	When the sensor is pressed	decrease	TRUE
	When the sensor is not pressed	increase	FALSE
CDS SENSOR	When sensor is covered	increase	FALSE
	When not cover the sensor	decrease	TRUE
IR SENSOR	When sensor is covered	decrease	TRUE
	When not cover the sensor	increase	FALSE
POTENTIOMERTER	Clockwise	decrease	TRUE
	counterclockwise	increase	FALSE

CLASS 3

Infrared (IR) Sensor Coding Experience

Coding a mini windmill with an ir sensor

In the flowchart, you can see that the digital input value is the same as the button sensor.



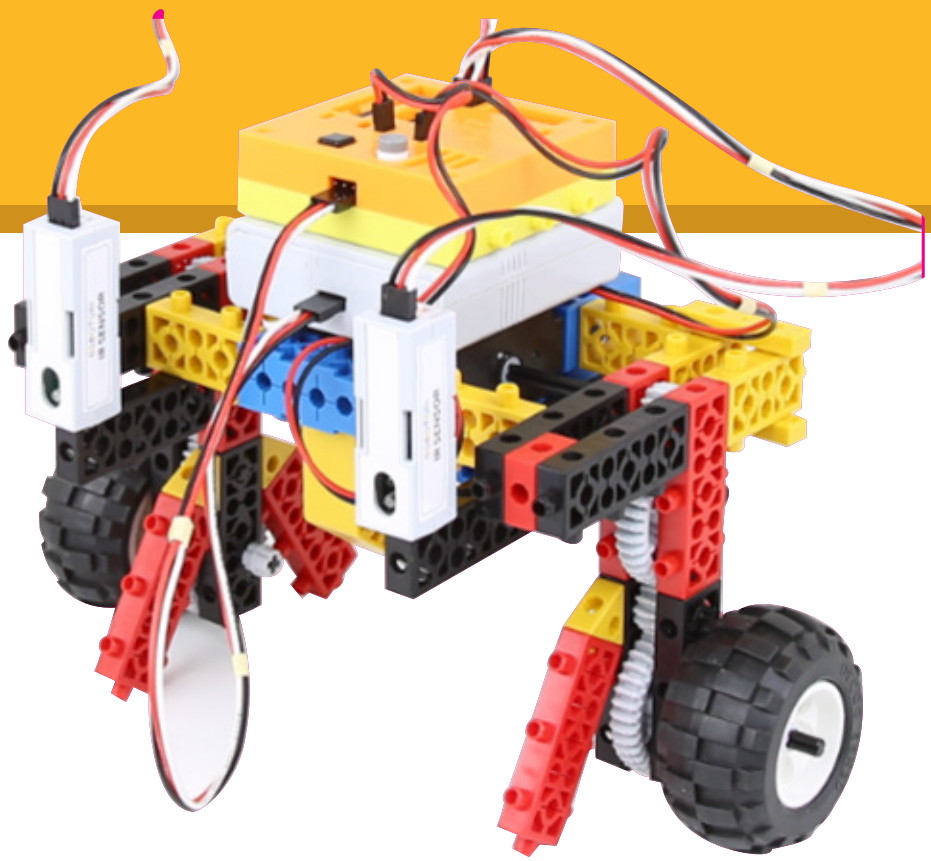
When you put your finger on the infrared sensor, the motor will turn on.
If not, the motor turns off.

SCRATCH CODING KIT

Logic Boost

Nested ‘if’ syntax

LESSON 2

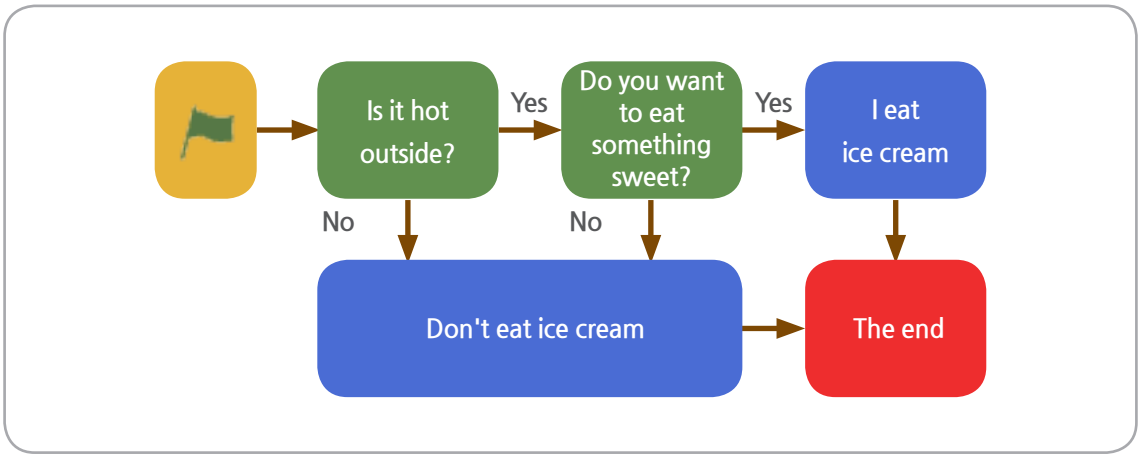


CLASS 3

Introduction

'If' syntax in 'if' syntax

This time we will learn the 'if' syntax in more detail.



We eat ice cream when we want to eat sweets or it's hot and we don't otherwise.

Here we need two 'if' statements. First, I'll check to see if it's hot outside and the second time I want to eat sweet.

This is called "Nested 'if' Syntax"

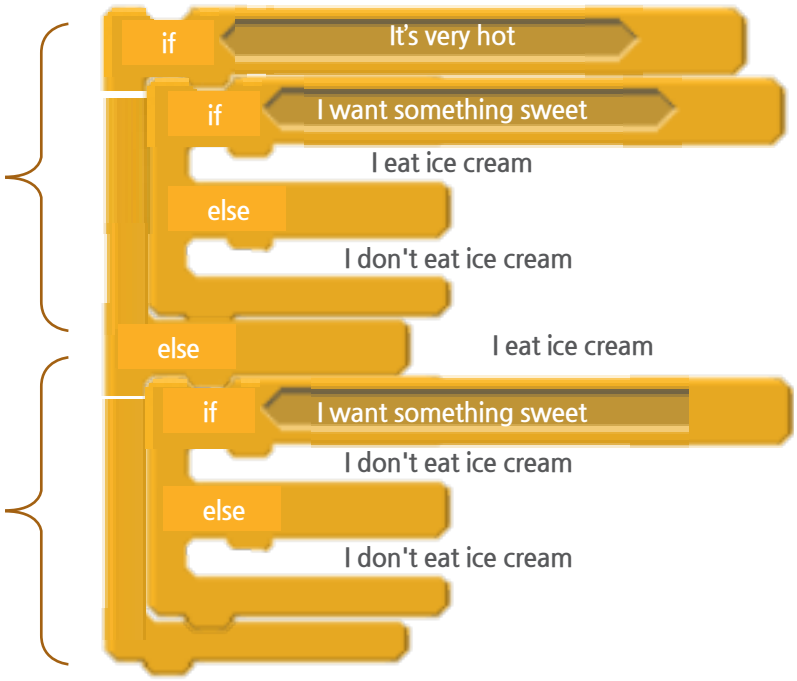
Introduction

Nesting 'if' syntax in scratch

Let's see how the ice cream case turns into a scratch.

If the weather is cold and we want sweets, we'll have ice cream. If we do not want sweet, we will not eat ice cream.

If the weather is not hot, we will not eat ice cream even if we want something sweet.

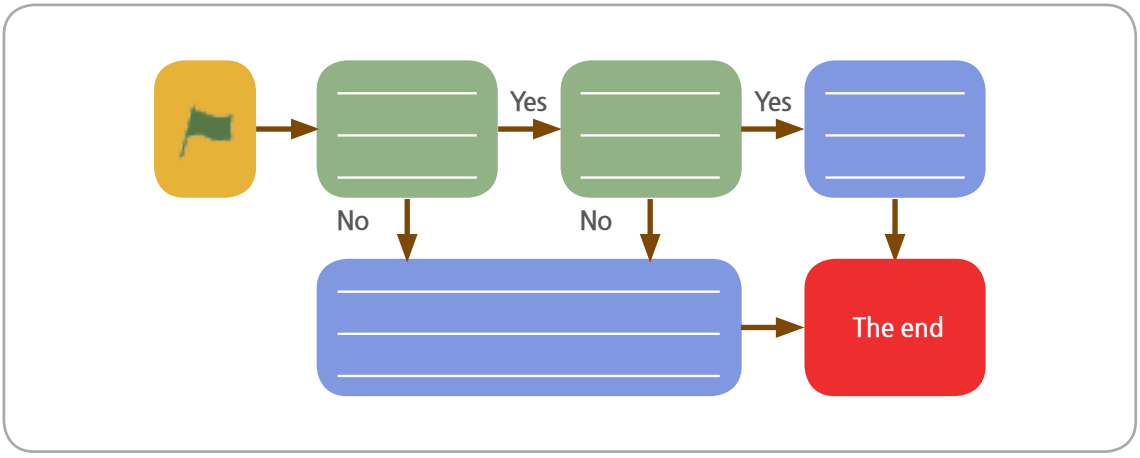


CLASS 3

Introduction

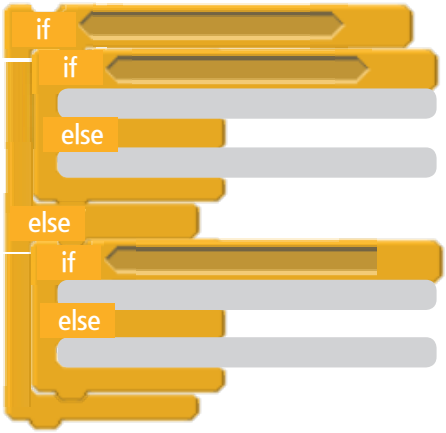
Create your own quotes ‘if’ syntax example

Now write your own 'if & else' syntax example here



Create your own ‘if’ syntax example

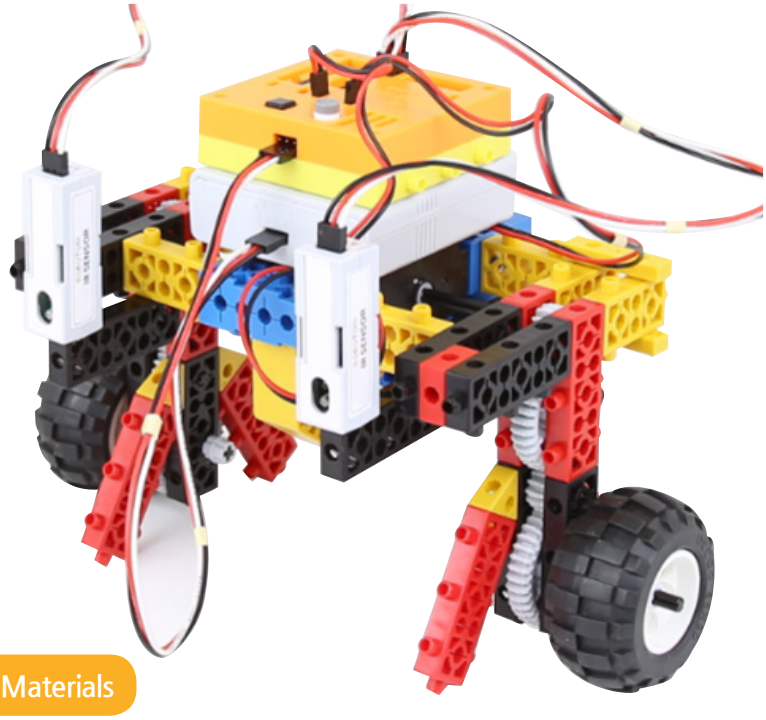
Now convert your example to scratch



Making a Robot

Making the Bot Come

We'll make a robot that follows your hand to understand the nested 'if' syntax.



Moving bot Materials

											
Diamond H8 x4	Diamond V8 x3	Rubi 7 x 4	Rubi 6 x5	Rubi 4 x8	Rubi 2 x4	Rubi 0 x2	Mini 2 x8	Mini 1 x2	Curve x2	Link x4	Triangle x4
											
Sawtooth 12 x4	Sawtooth 36 x4	Short connector x4	Mainboard 128 x1	Battery case x1	Off-road wheel x2	DC motor x2	IR sensor x2	A 23 x4	A 45 x2	A 64 x2	Connector x3

CLASS 3

Making a Robot

Making the moving bot

1 **1-1**

x 1

x 2

x 2

1-2

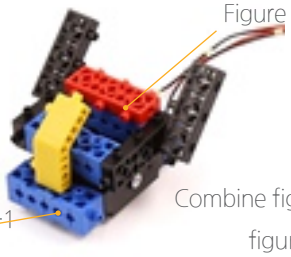
x 4

x 1

x 2

45 degree angle

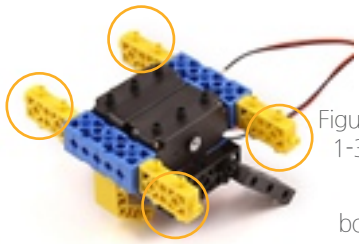
1-3



Combine figure 1-1 and figure 1-2

1-4

x 4



bottom

2 **2-1**

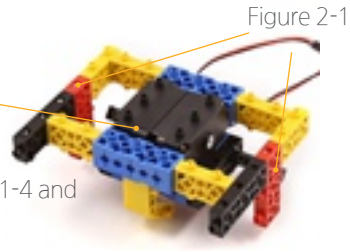
Make two of these

x 2

x 2

x 2

2-2

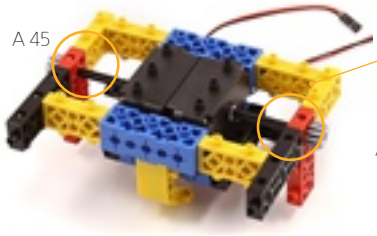


Assemble figure 1-4 and figure 2-1

2-3

x 2
A 45

x 2



Making a Robot

Making the moving bot

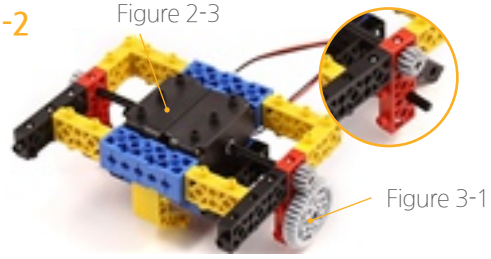
3 3-1

x 2
A 23

x 2

Make two of these

3-2



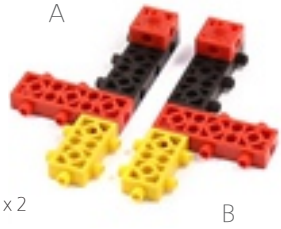
3-3

x 2

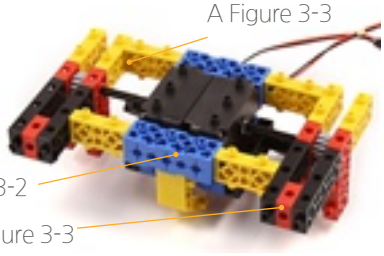
x 2

x 2

x 2



3-4



4 4-1

x 4

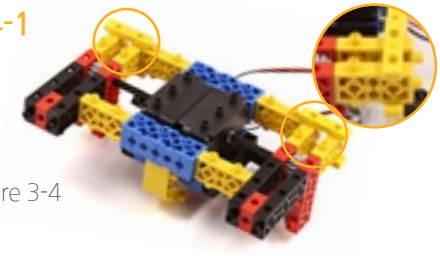


Figure 3-4

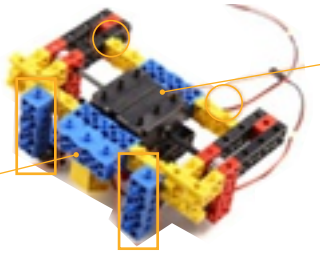
4-2

x 1

x 1

4-3

x 2



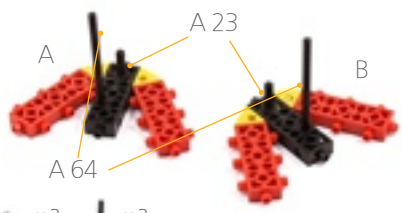
CLASS 3

Making a Robot

Making the moving bot

5

x 2
x 4
x 4
x 2 A 23
x 2 A 64



5-2

x 2
x 2

5-3

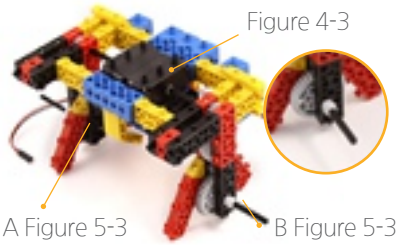
x 2
x 2

* caution

A

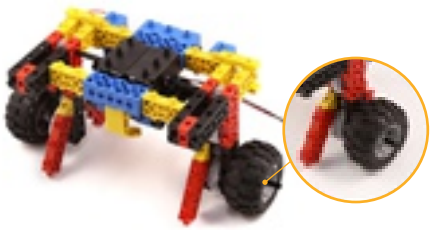
B

5-4



6

x 2
x 2



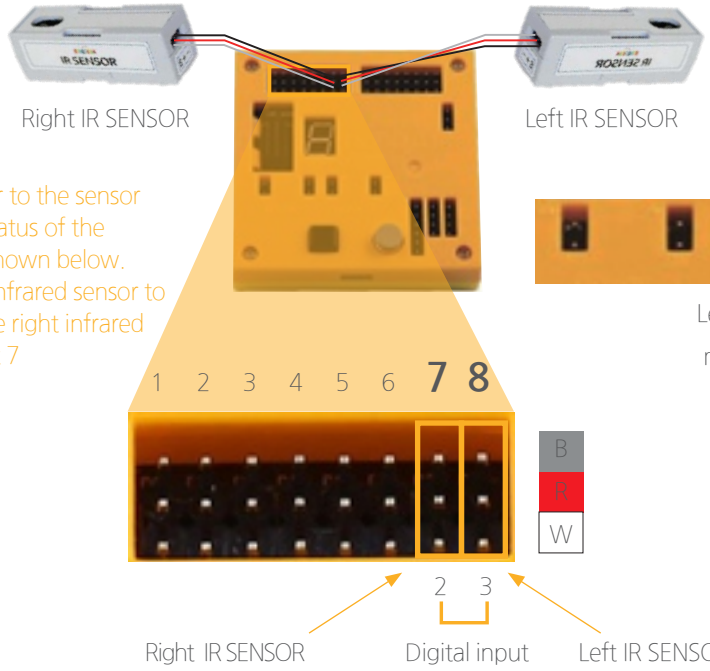
7

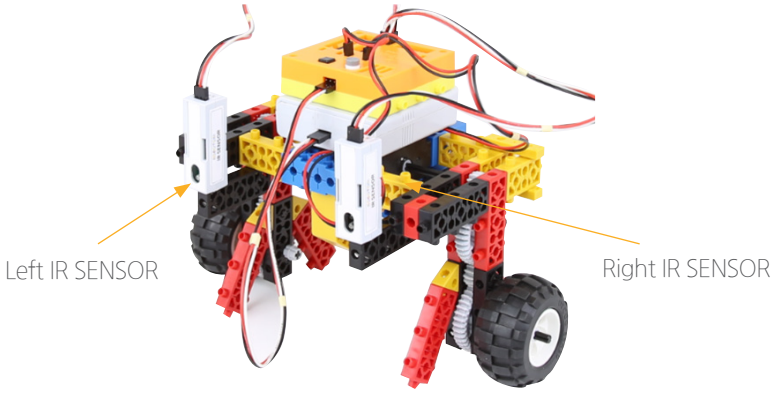
x 2
x 1
x 1
x 2
x 3

Learning Coding of Moving Bots

Making the moving bot

8





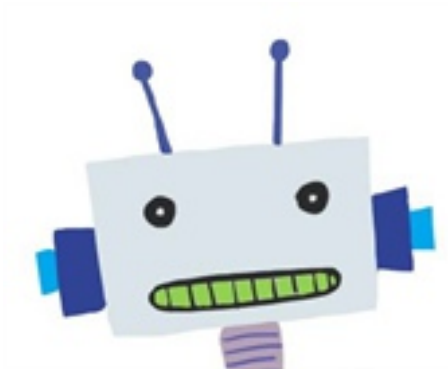
CLASS 3

Learning Coding of Moving Bots

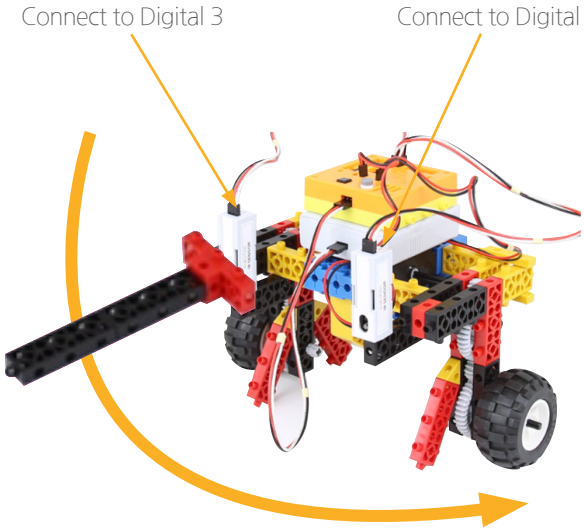
Programming the Moving Bot

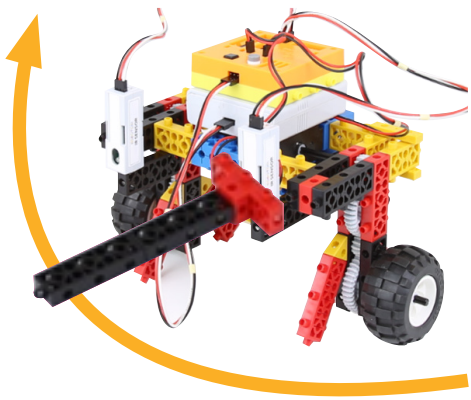
Unlike the one we used before, we'll use the infrared sensor as the "eye" of a moving bot.

When you cover the left sensor,
the robot goes to the left.



Cover the right sensor and the robot
will go to the right.

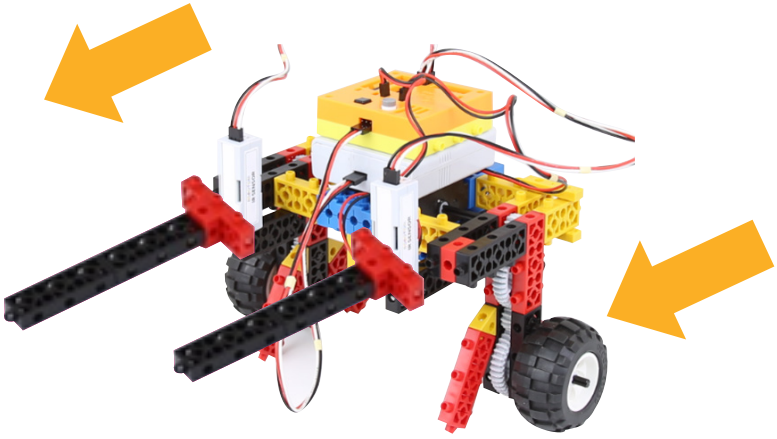




Learning Coding of Moving Bots

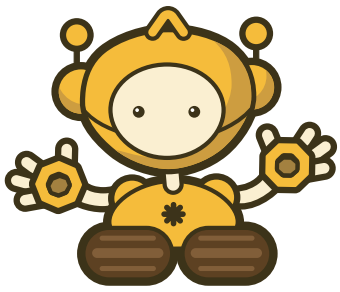
Programming the Moving Bot

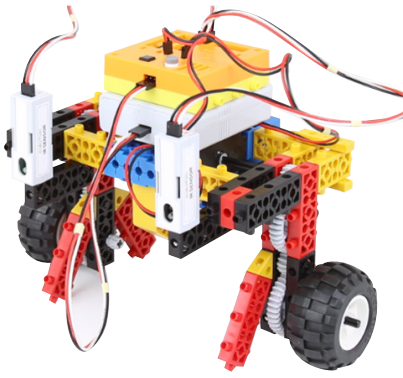
If both infrared sensors are covered, the coming bots are moving forward.



To make our moving bots perform four different actions (left, right, forward, and stop), we need the 'if' syntax many times.

As in the case of ice cream, we'll use the nested 'if' syntax to program the moving bots



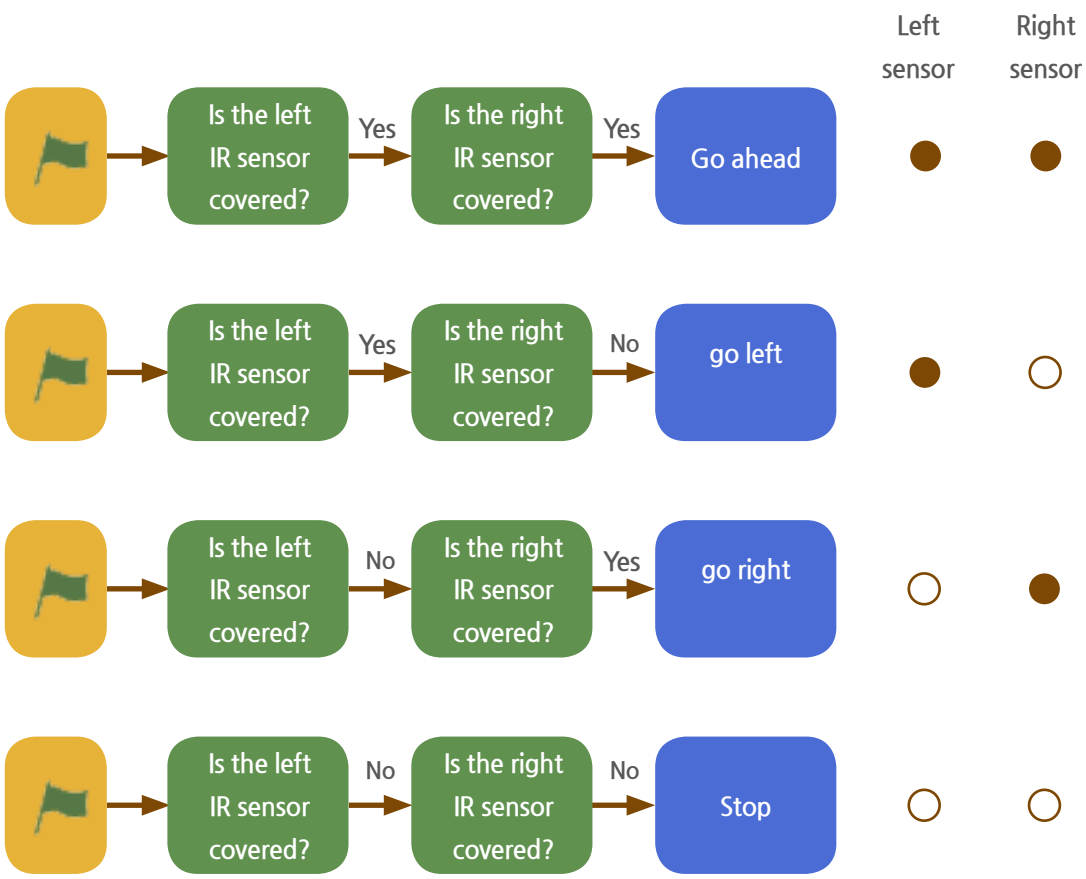


CLASS 3

Learning Coding of Moving Bots

Programming the Moving Bot

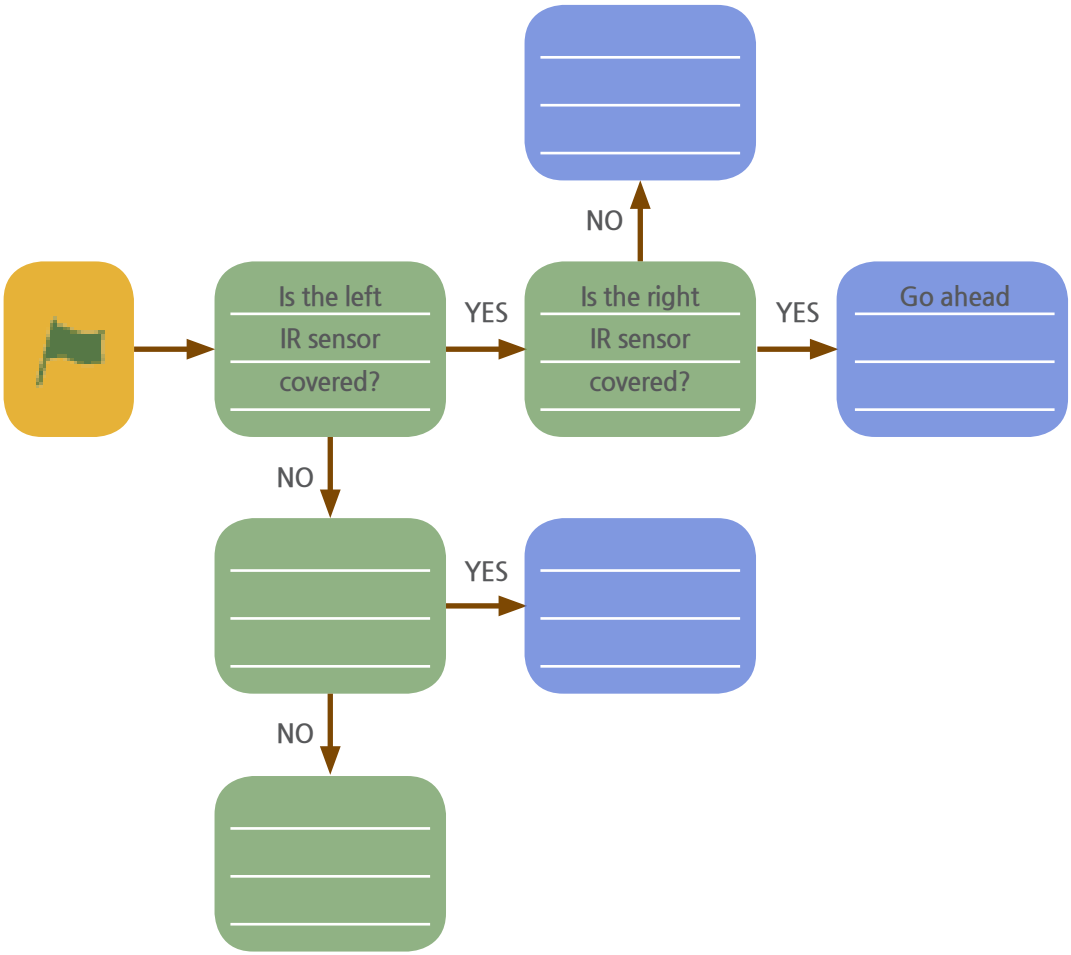
If we wanted to write four programs to control the moving bots, the flow chart would look like the one below.



Learning Coding of Moving Bots

Programming the Moving Bot

Combine four different programs into a single flowchart. Think of an infinite loop in the flowchart.

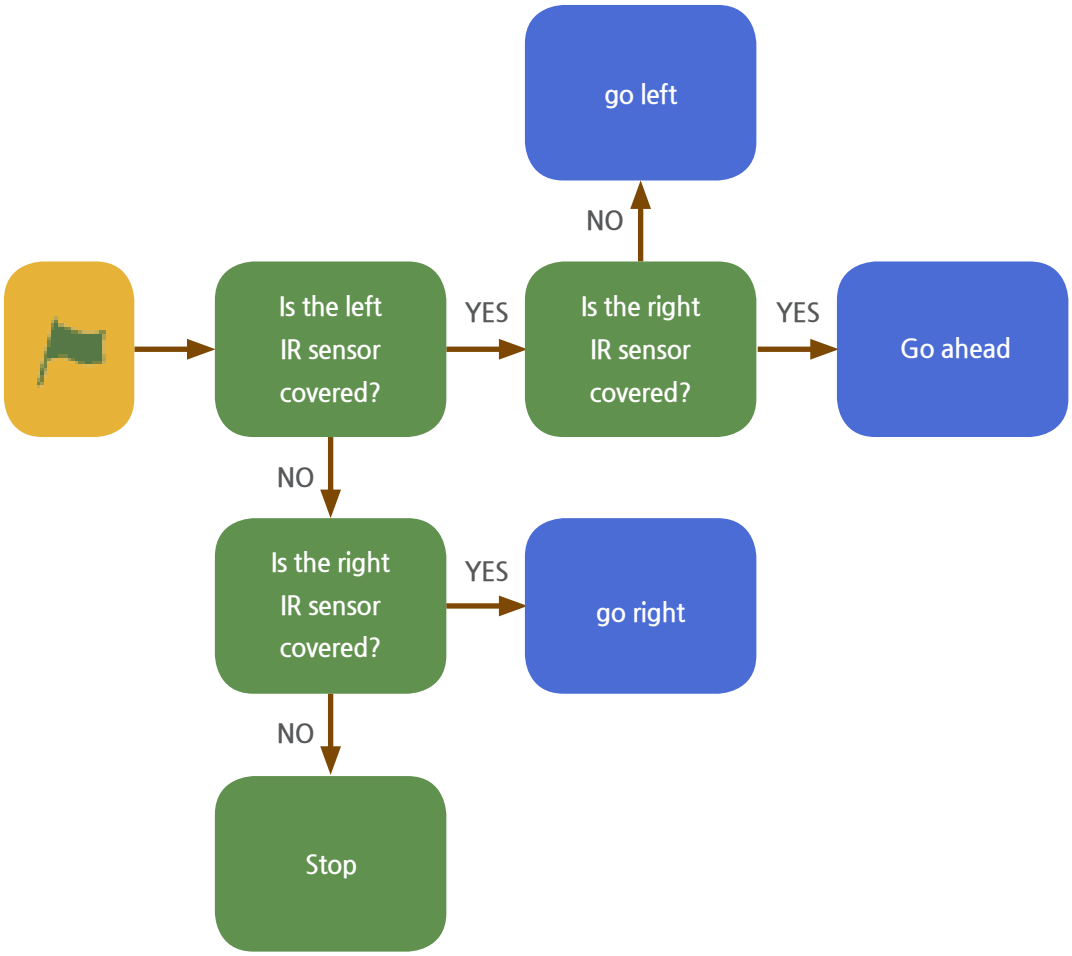


CLASS 3

Learning Coding of Moving Bots

Programming the Moving Bot

Your flowchart will look like this: Think of the flowchart as having an infinite repeat block.



Learning Coding of Moving Bots

Programming the Moving Bot

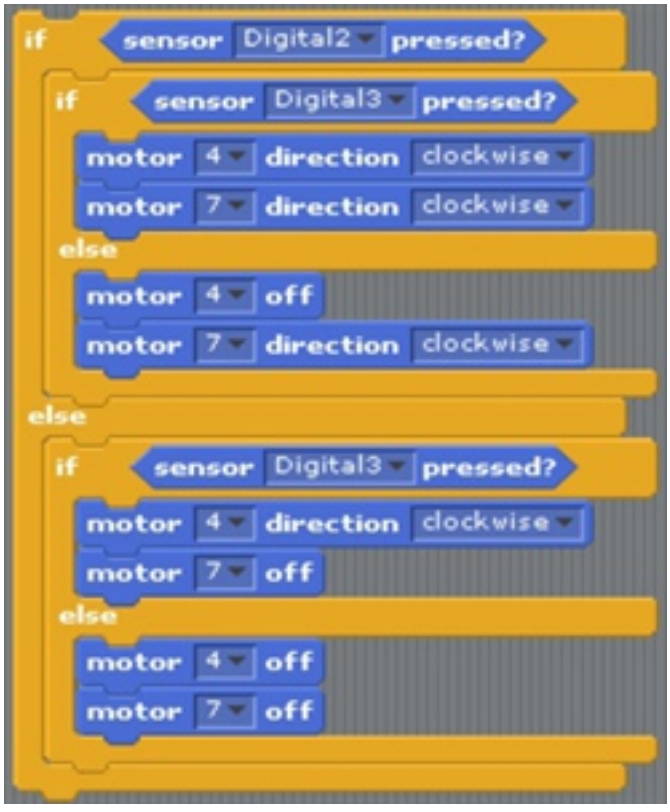
Let's take a look at the scratch code below and see how the moving bots move.

If the left infrared sensor and the right infrared sensor are covered, the coming bots are moving forward.

If you cover only the left infrared sensor, the coming bots will move to the left.

If the left infrared sensor is not covered and the right sensor is covered, the humming bots will move to the right.

If the infrared sensor is not covered, the moving bots are moving forward.

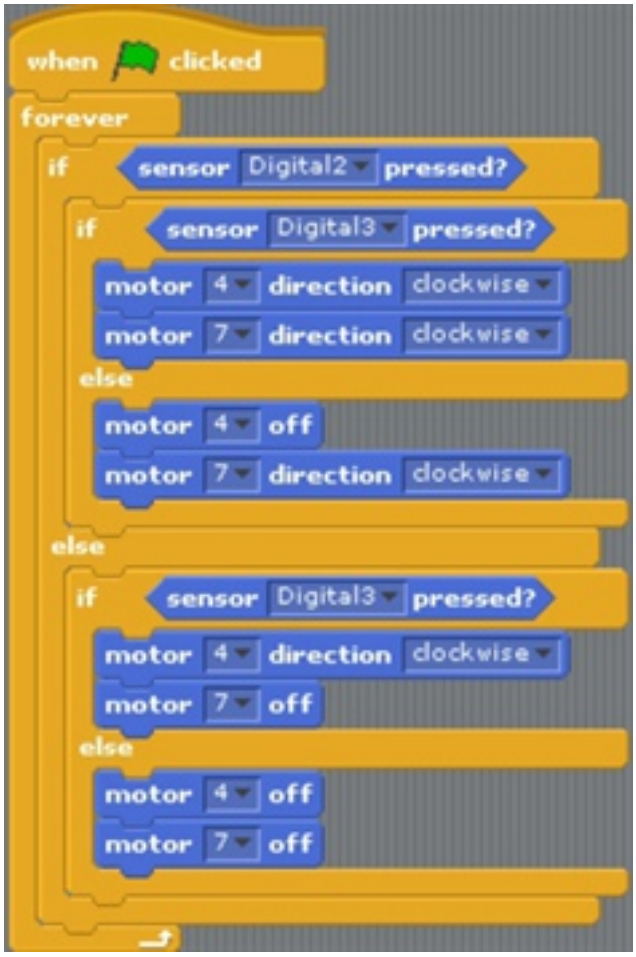


CLASS 3

Learning Coding of Moving Bots

Programming the Moving Bot

Now we need an infinite loop and a start block to complete the code. You can now make a moving bot that follows.

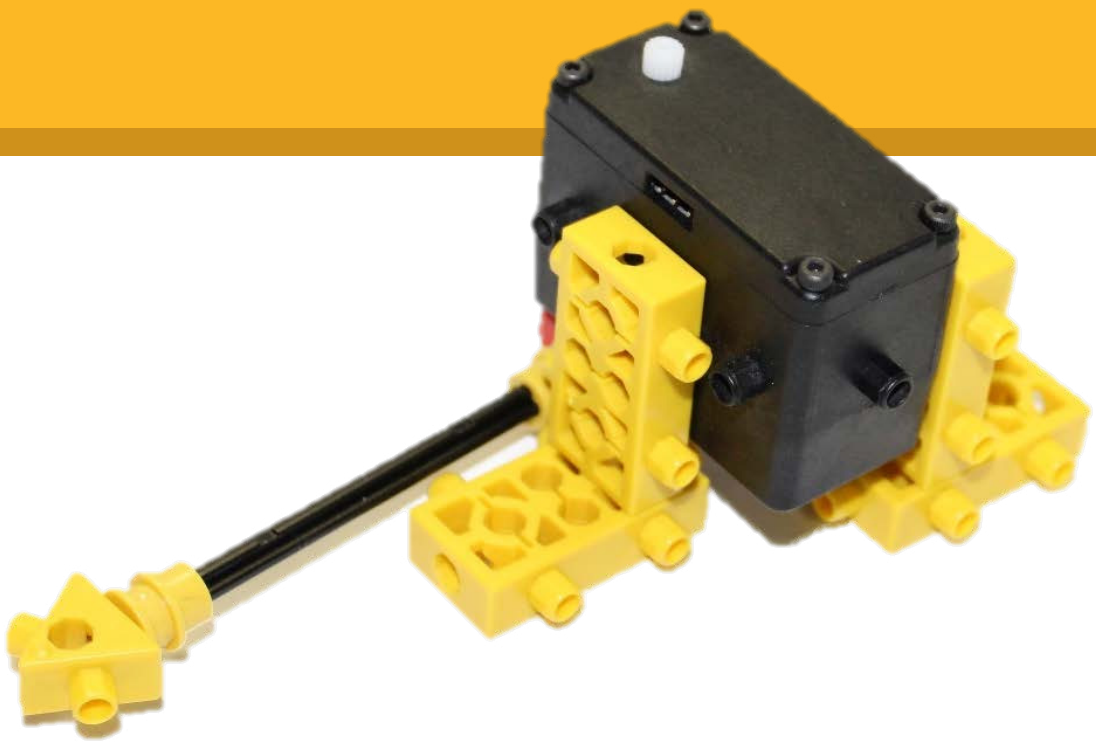


SCRATCH CODING KIT

Logic Boost

IR Sensor Utilization

LESSON 3

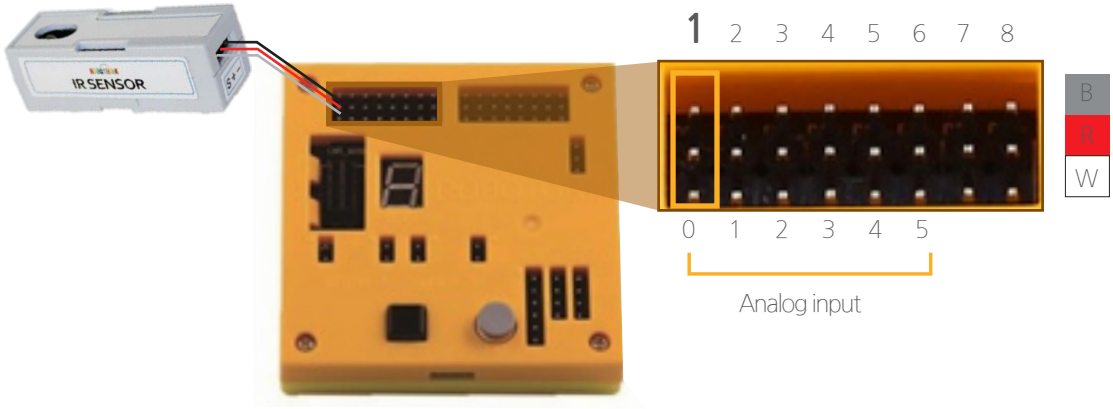


CLASS 3

Connecting Main Cell

Connecting an IR sensor to an Analog port

Connect the infrared sensor to the analog port of the mainboard

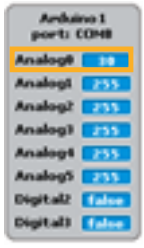


Plug the infrared sensor into the port and check the values below!

You can see that the value of the Analog0 port changes! This is the analog value of the infrared sensor. When you cover the infrared sensor with your fingers and release it again, you can see that the value goes down and then goes up again.

If you leave the infrared sensor, you can see that the value of "Analog0" revolves around three digits.

If the infrared sensor is covered, you can see that the value of "Analog0" spins two digits

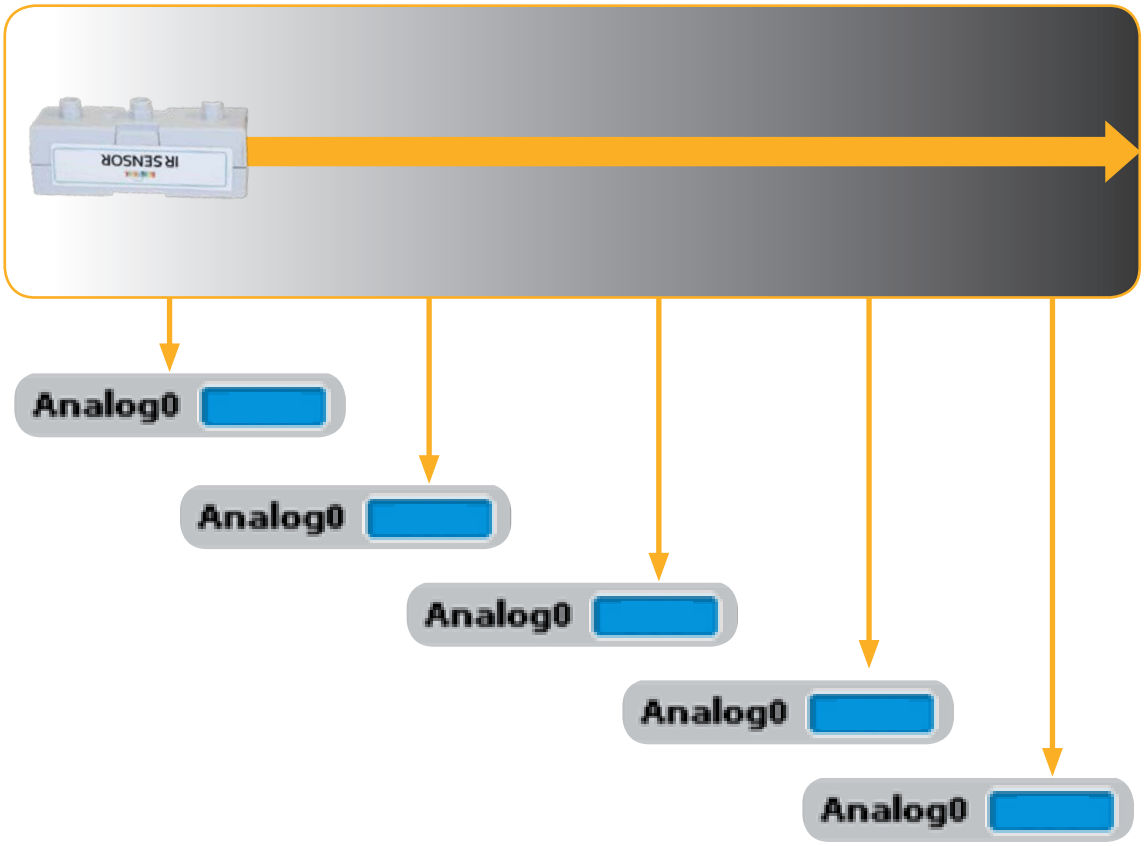


Instead of using true or false to express darkness and brightness, we will use numerical values to show what infrared sensors are seeing.

IR Sensor coding practice

Analog value of IRsensor

Keep your infrared sensor flat on the bottom of the gradient box. You will find that the analog output values change slowly. Write down the values from each specific point in the empty bin below.

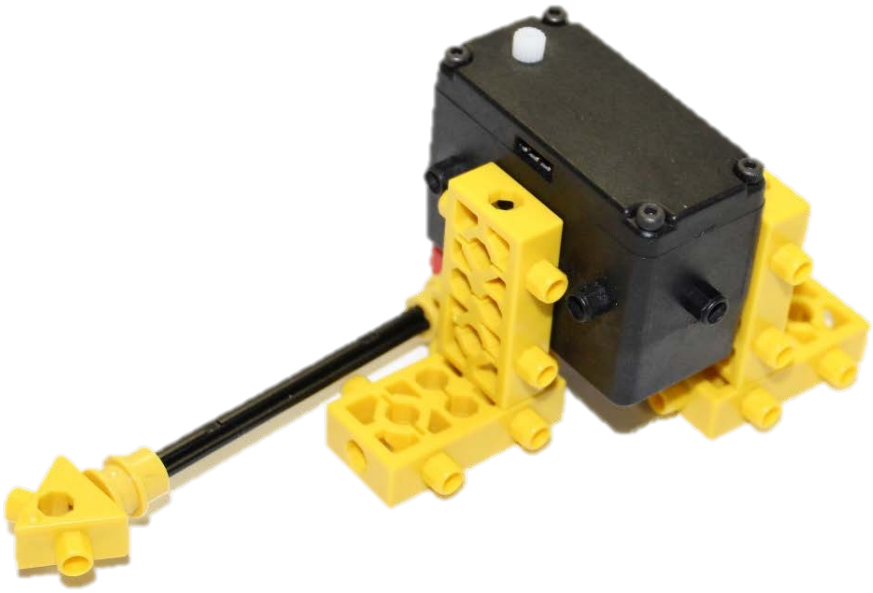


CLASS 3

Making a Robot

IR sensor Analog Meter

We will now use servo motors to display the values of the infrared sensors. Let's make a meter! Before starting, set the servo angle to 0



Meter Materials

									
Servo x 1	Mini 2 x 4	Motor connector x 2	Triangle x 1	Connector x 2	A 64 x 1	IR SENSOR x 1	Servo motor x 1	Battery Case x 1	Main board 128 x 1

Making a Robot

Making a Meter

1


x 2

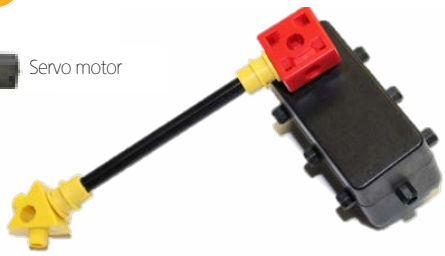

x 1


x 1
A 64


x 1

2 Combine them with the angles shown below


Servo motor



3


x 4

4

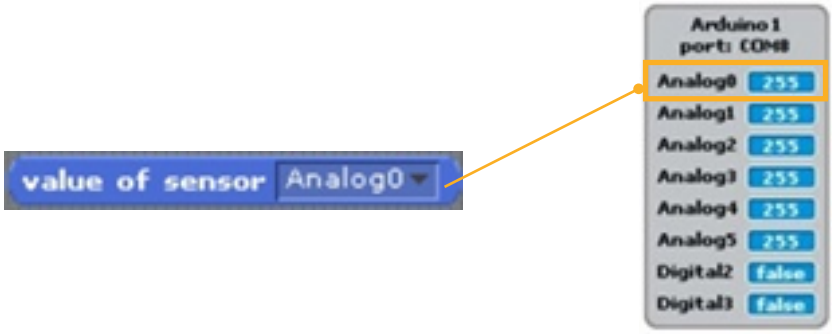
Complete

CLASS 3

Coding a Meter

Coding a Meter

Like digital blocks, there are blocks that represent analog values.



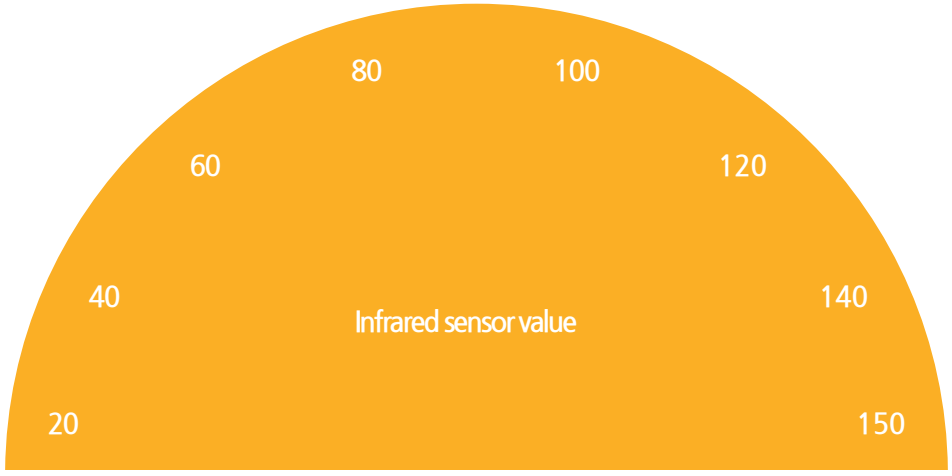
As we learned earlier, the servomotor operates according to the angle the user commands. Try to operate the servo motor according to the value of the infrared sensor. If the infrared sensor value is 0, the servo motor will move to 0, and if the infrared sensor value is 180, the servo motor will move to 180 degrees.

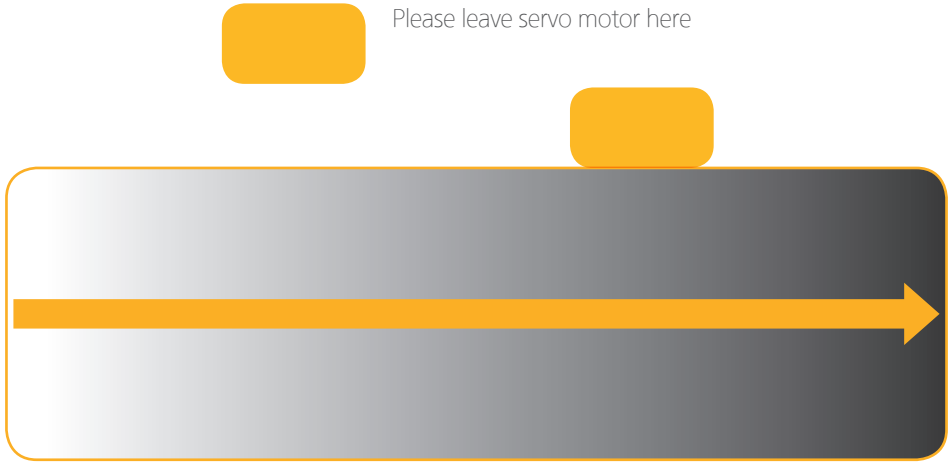
Since the angle to be controlled is in the servo motor operation block, put the analog sensor value in the motion block. Now add an infinite loop block to complete the code.

Coding a Meter

Coding a Meter

Drag the infrared sensor along the bottom gradation piece to see if the servomotor is acting as a meter.



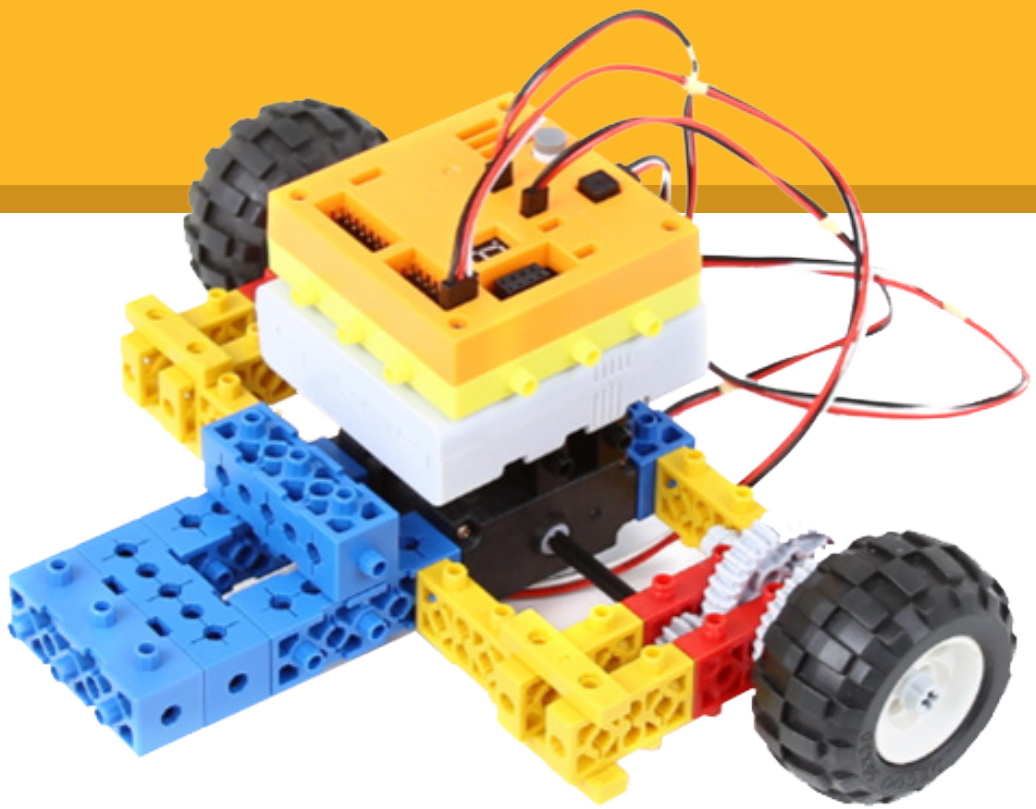


SCRATCH CODING KIT

Logic Boost

Line Follower

LESSON 4



Making a Robot

Activity Introduction

Now we're going to make line followers with what we've learned about operators and thresholds.

Line followers Materials

											
Diamond H8 x 2	Diamond H6 x 3	Diamond V6 x 1	Rubi 6 x 5	Rubi 4 x 2	Mini 2 x 8	Link x 4	Triangle x 2	Sawtooth 12 x 4	Sawtooth 36 x 4	Middle Connector x 4	Off-road wheel x 4
											
A 45 x 2	A 64 x 2	Battery case x 1	DC Motor x 2	Mainboard 128x 1	IR SENSOR x 1	connector x2					

CLASS 3

Making a Robot

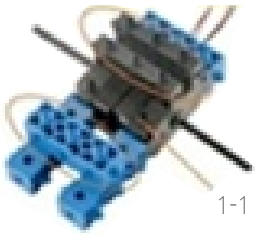
Making a line follower

1 **1-1**

x 1
x 2
x 2 A 45
x 2

1-2

x 1
x 2



2 **2-1**

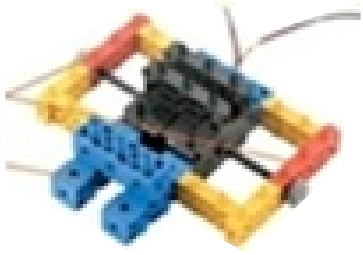
x 6
x 2

Make two of these

2-2

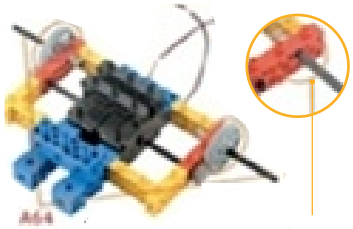
x 2

2-1
1-2



3 **3-1**

x 2 A 64
x 2
x 2

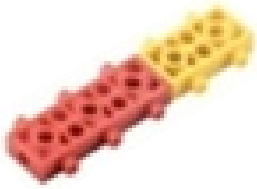


caution

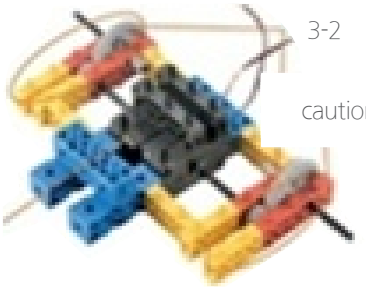
3-2

Make two of these

x 2
x 2

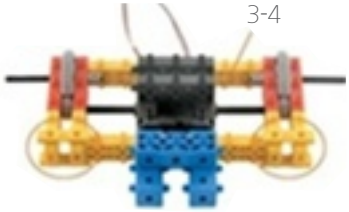


3-3



3-4

x 4



Coding Line Follower

Making a line follower

4 **4-1**


x 2

3-4

4-2


x 2


x 2

4-1

5 **5-1**

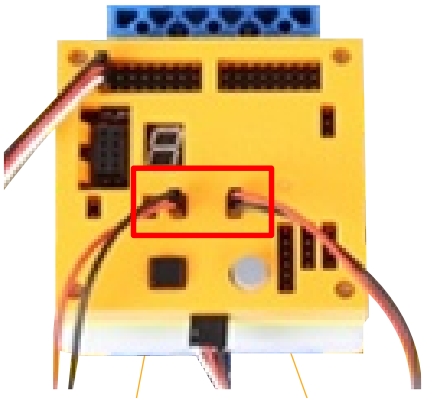

x 1


x 1

5-2


x 1

6



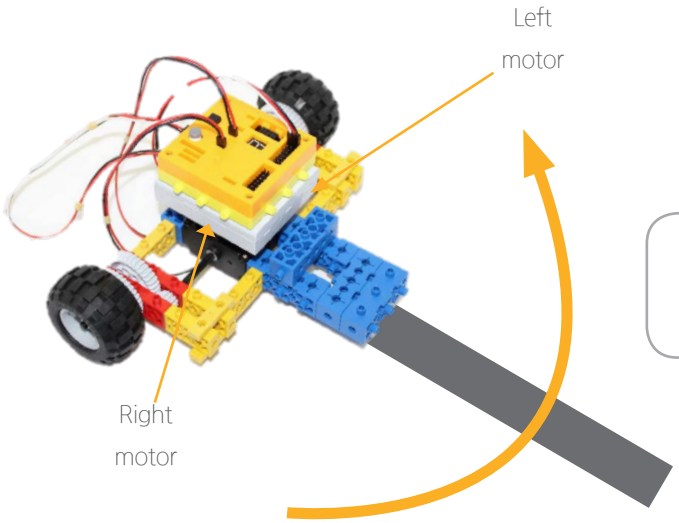
CLASS 3

Coding Line Follower

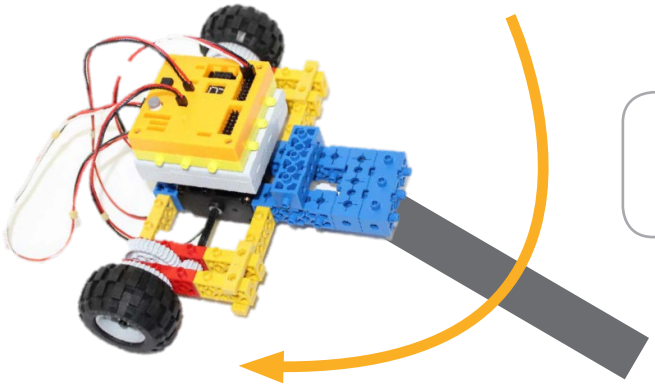
Coding a Line Follower

Code line followers. Line followers will use infrared sensors to find black lines.

The infrared sensor can tell if the car is on the line. The program will use the following logic to move the car along the line.



1. If the infrared sensor is on the black line, the car will activate the right motor and break it to the left.



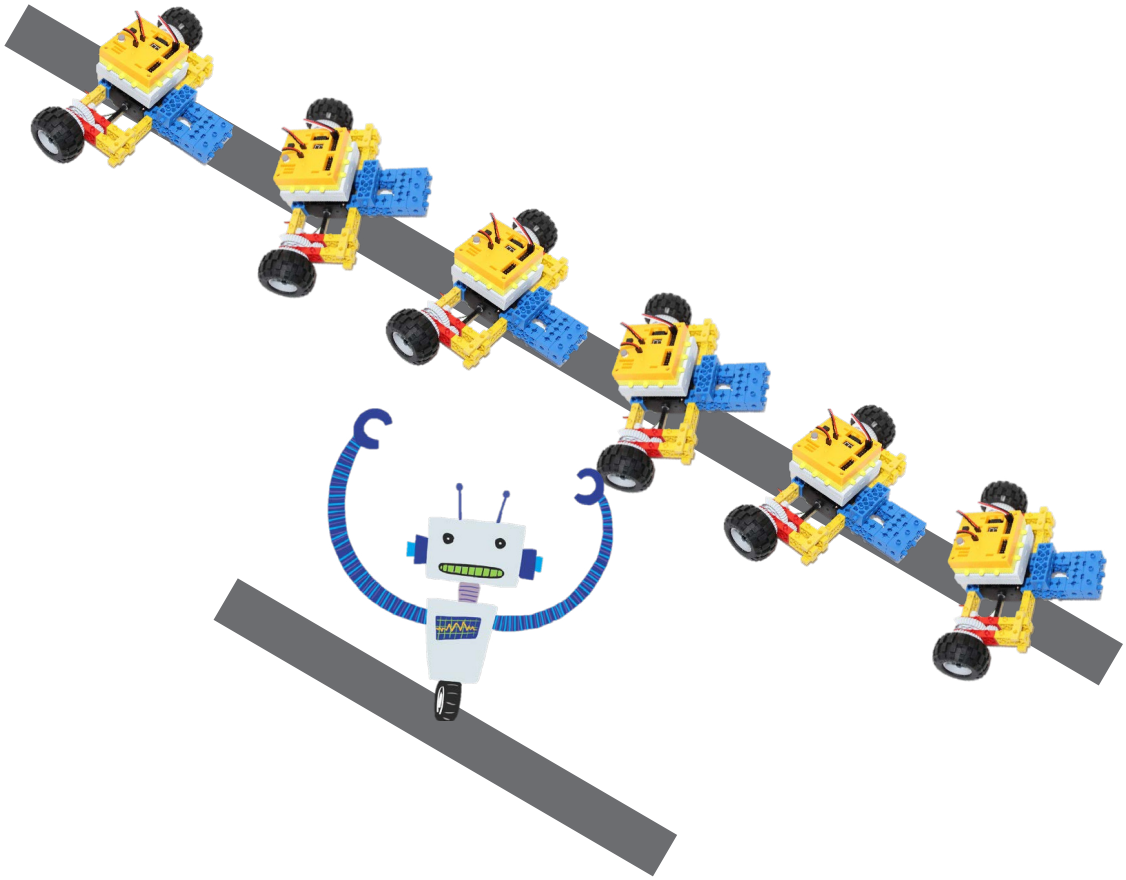
2. If the infrared sensor is not on the black line, the car will drive the left motor and break it to the right.

Coding Line Follower

Coding a Line Follower

That is, when the infrared sensor detects the line (the black area absorbs the light and the light is less reflective), the line follower will move out of the left line.

If the infrared sensor no longer detects the line (if there is a lot of light reflection), the line follower will move to the right. The infrared sensor will detect the black area again and go to the left. This cycle repeats until the line follower follows the line.

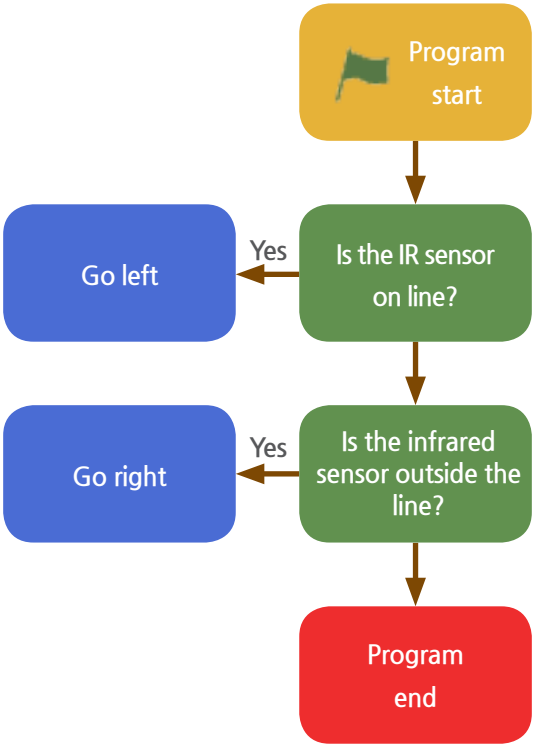


CLASS 3

Coding Line Follower

Coding a Line Follower

The program will check whether the infrared sensor is on the line or not and move accordingly. Check the flowchart below and think of the program as having repetition.



Coding Line Follower

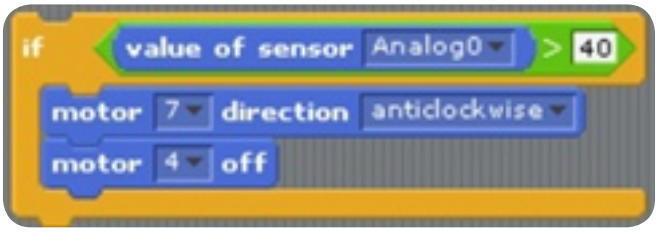
Coding a Line Follower

Write down the program step by step. First, write down when the infrared sensor value is on the line. Use the black line below.

The value when the infrared sensor is on line

The value when the infrared sensor is out of line

First, we need the 'if' syntax to tell us what to do if the infrared sensor is on the line.



If the sensor value is high (if the infrared sensor is on line), the right motor will turn on and move the car to the left and out the line! Be sure to check the direction of the motor counterclockwise or clockwise to see which value causes your line follower to move to the left.

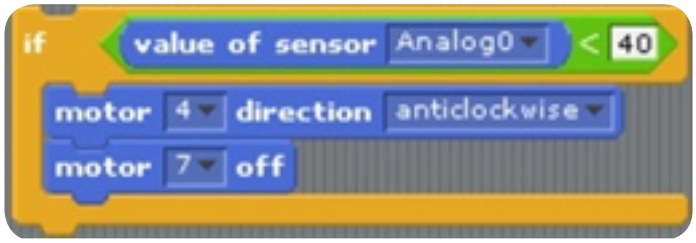
You can set the threshold value based on the values above the black line and above when you are outside the black line. Should you choose between the values above the black line and those outside the black line?

CLASS 3

Coding Line Follower

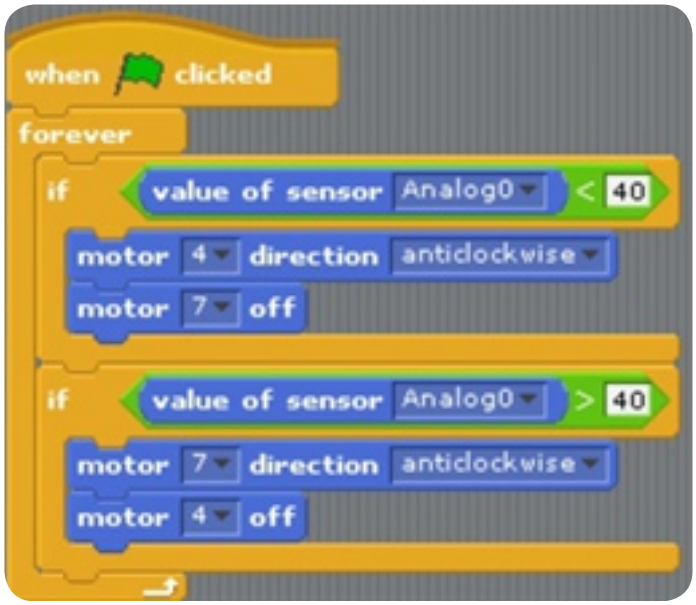
Coding a Line Follower

The next code to make is when the infrared sensor is out of line



If the infrared sensor value is low (the infrared sensor is outside the line), you should turn the left motor on and move the car to the right until the infrared sensor is above the line.

Combine the two programs and add an "Forever" block.



Run the program and run your line follower by printing the next page

Use this page as long as you want the line follower to move.

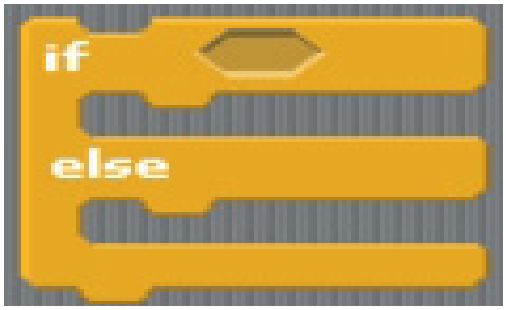
CLASS 3

Coding Line Follower

Replace IF statement with IF and Else statement

In the previous code, we wrote two 'if' statements to make the code work. We can replace two 'if' statements with a 'if & else' statement. Try it!

※The whole script can be found at http://www.robotori.com/web_eng -> Moretips -> Manual ->EDU ->Logic boost CODING CLASS 3 ->download whole script



Use electric tape to create your own tracks that will follow your line followers. When you create a track, make it 8cm thick at first, then try to make the robot work by gradually reducing its thickness.

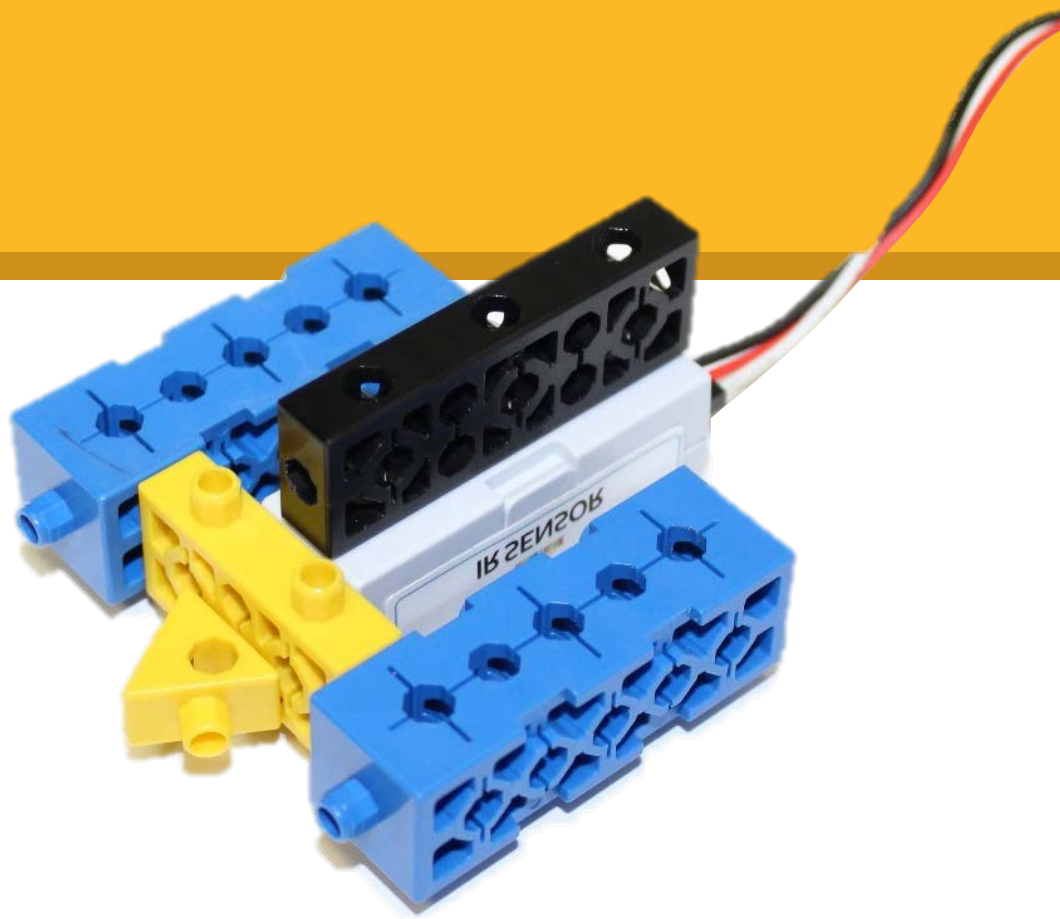
5 CM

SCRATCH CODING KIT

Logic Boost

DJ Box

LESSON 5



CLASS 3

Conditional Operator

Introduction

Here you are going to first learn the conditional operator to make a DJ box. Conditional operators are operators that compare different conditions. Look at the conditional operator below.

Condition 'and' -condition 'and' must satisfy both left and right conditions.

Look at the example of the conditions 'and' below.

= false

true + false

The reason the above condition is false is that the left condition is true but the right condition is false. 3 is not less than 2. So the whole condition is a lie.

= true

true + true

The above conditions are true because the left and right conditions are both true. So the whole thing is true.

Conditional Operator

Introduction

Condition 'or' -condition 'or' is true if only one of the left or right is true.

See the example of the condition 'or' below.

= true

true + false

In the condition 'or', the left is true and the right is false. Because one condition is true

= true

true + true

In the example above, both conditions are true, so the whole condition is true.

= false

false + false

the example above, the entire condition is false because both conditions are false.

CLASS 3

Conditional Operator

Introduction

Condition 'Not' - Condition 'Not' is true if the condition in is false.

Look at the examples below for the condition 'not'

false

= true

The condition is not true because the condition above is false.

true

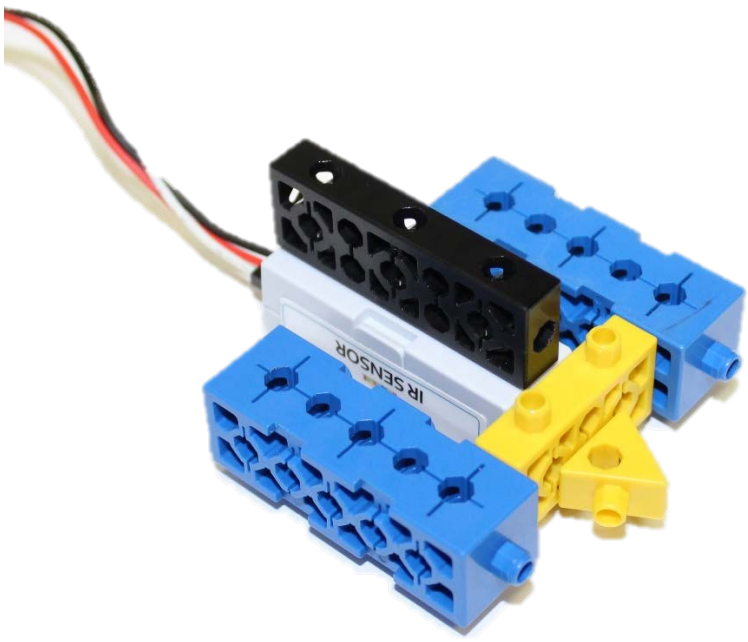
= false

The condition is not true because the condition inside is false.

Making a Robot

DJ Box

Utilizing the knowledge of conditional operators, we are now going to make a DJ box that uses an infrared sensor to make the instrument sound. Use the picture below to create a DJ box.



DJ BOX Materials

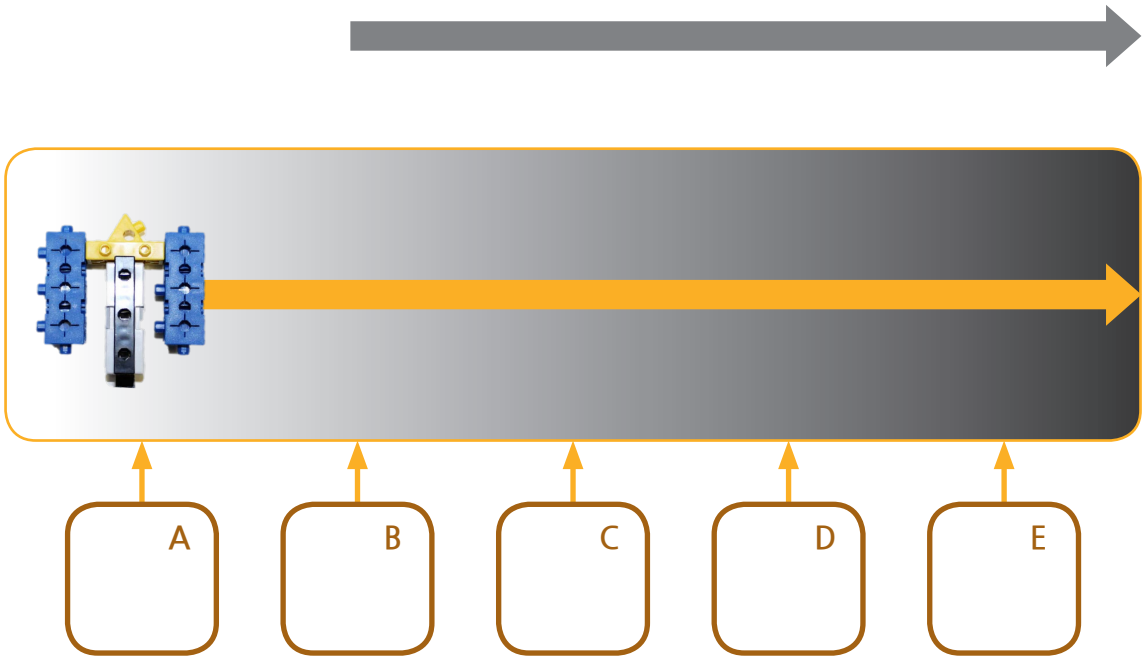
							
Diamond V8 x 2	Mini 2 x 1	Rubi 0 x 1	Triangle x 1	IR sensor x 1	Connector x 1	Battery Case x 1	Main board 128 x 1

CLASS 3

Coding the DJ Box

DJ BOX

Below is the gradient box from white to black. Move the DJ box's infrared sensor near the gradient to see how the value changes. Write down the values when the infrared sensor reaches A, B, C, D, and E points.



The DJ box will play a different drum sound when the infrared sensor passes through each part of the gradient box shown above.

Coding the DJ Box

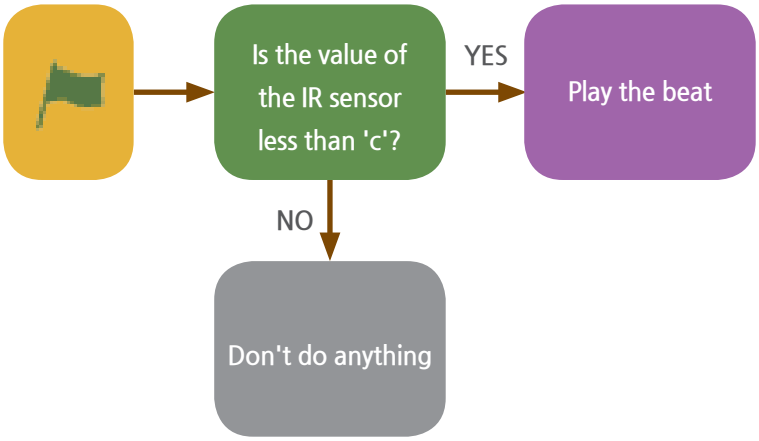
Coding the DJ Box

If you have exhausted the infrared sensor values, we will make the DJ box play different bits as the infrared sensor shows.
Scratch can make a lot of sound including drum beat. Go to the palette and choose Sound template.

Bring a block that looks like this 

Make sure you hear sound from your computer and click on the block. You can hear the drums on your computer. If you want to hear other drum sounds, try changing the value of the drum.

Now, if your infrared sensor is to the left of the "C" area of the gradient on the previous page, try creating a simple program that makes a sound. In this case, the value of the "C" box is the threshold value. Here is the flowchart showing how it works.



CLASS 3

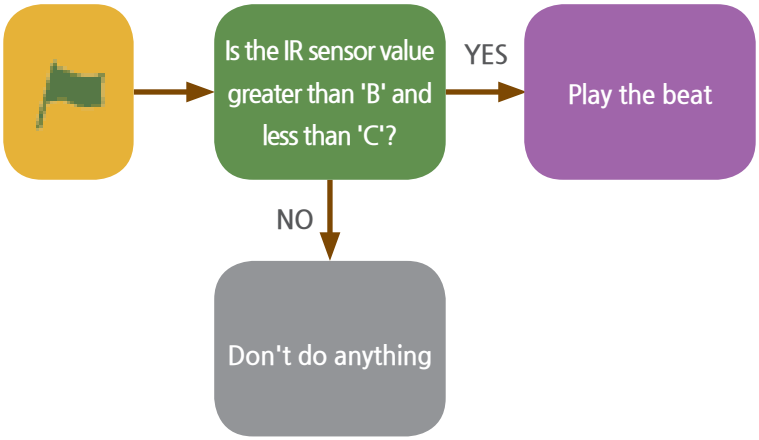
Coding the DJ Box

Coding the DJ Box

Here are the programs you need to create.

Now run the program. If you move the infrared sensor to the left of the "C" value, you can hear the drum sounds.

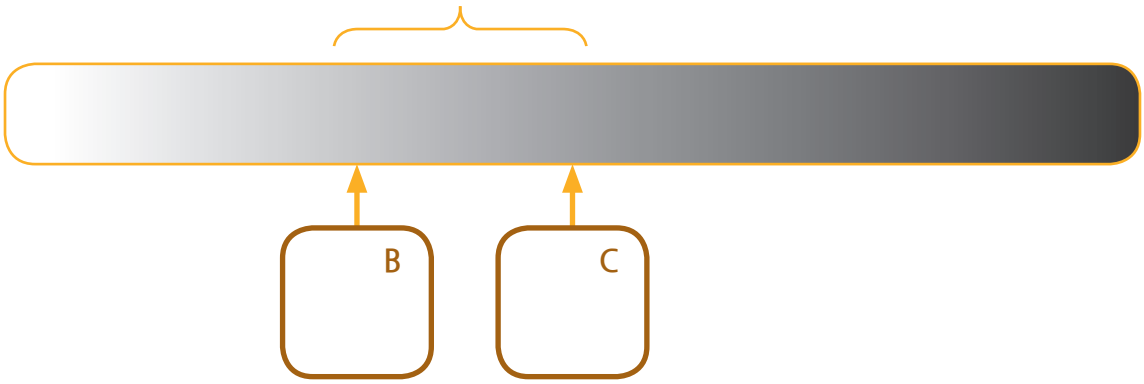
Now we are going to code a program that sounds multiple drums simultaneously at A, B, D and E values. To do this we need logical conditions. See the flowchart below..



Coding the DJ Box

Coding the DJ Box

If you want to play a particular beat between the B and C values with your DJ box, you have to write down the condition.



This means that the infrared sensor value must be greater than B and less than C. Look at the code below.

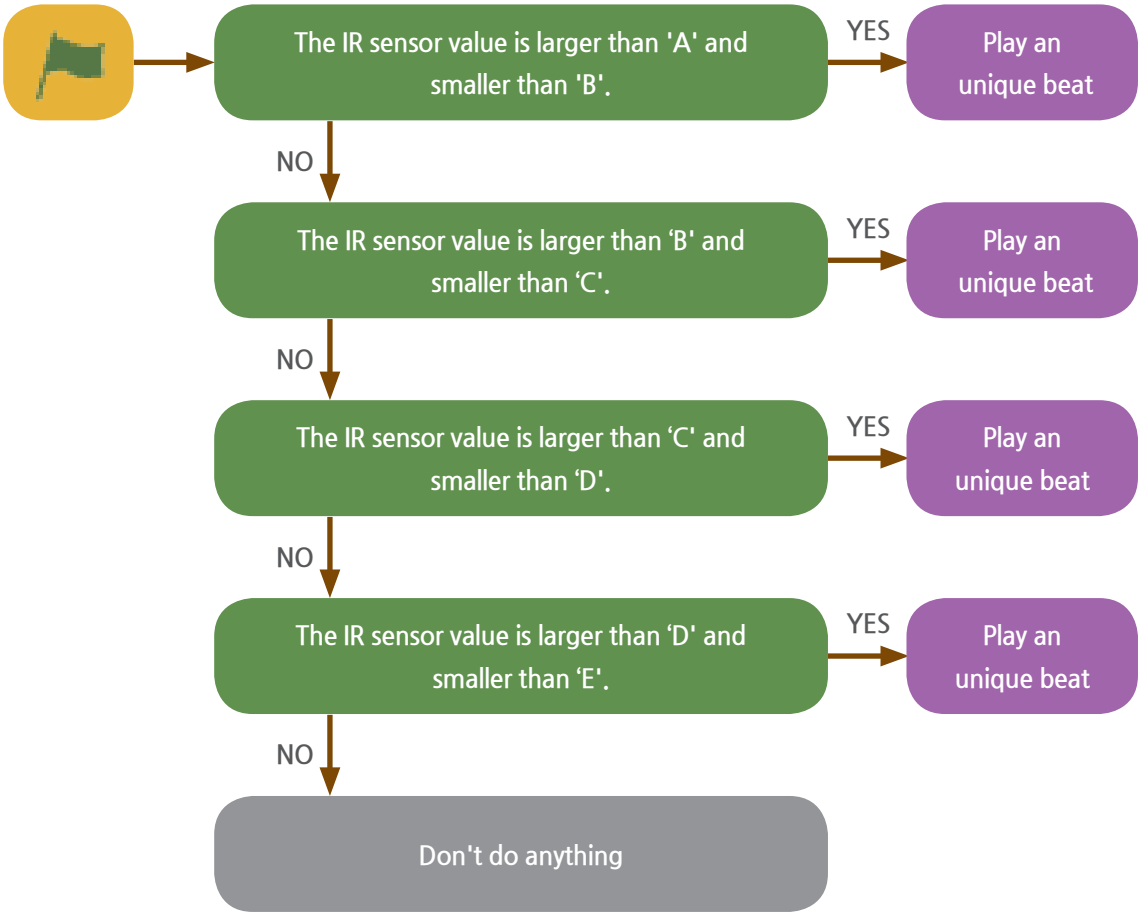
The condition shows that the IR value must be greater than B and less than C to be true unconditionally. If not, I will not play drum beat.

CLASS 3

Coding the DJ Box

Coding the DJ Box

Now let's repeat the above steps to make bits of the other region. We have to create three more bit areas, one between "A" and "B", between "C" and "D" and finally "D" and "E". Here's a logical flowchart, but you can create the rest of the program yourself.

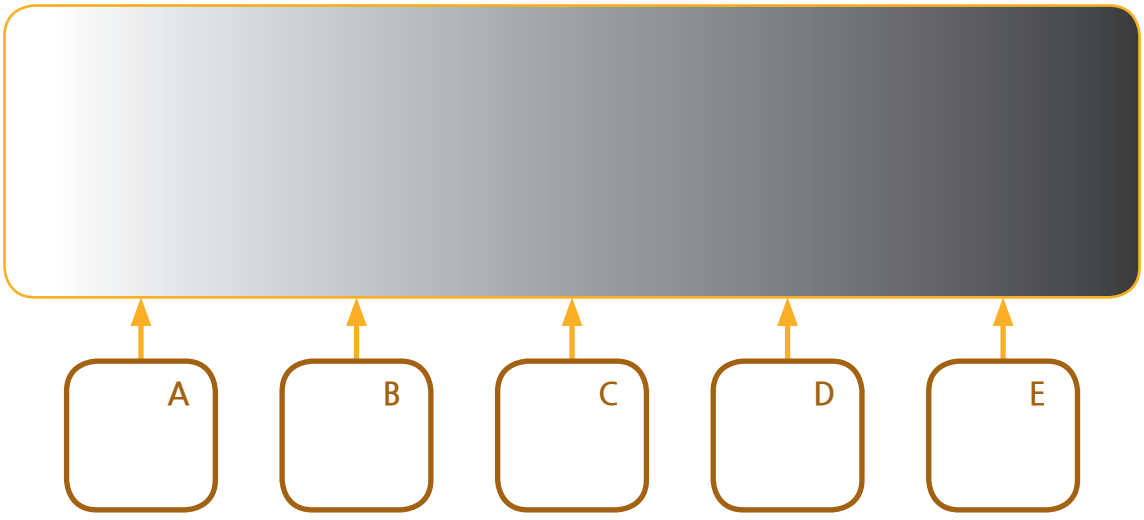


※ The whole script can be found at http://www.robotori.com/web_eng -> Moretips -> Manual ->EDU ->Logic boost CODING CLASS 3 ->download whole script

Coding the DJ Box

Play the DJ Box

Now play the beat you created!

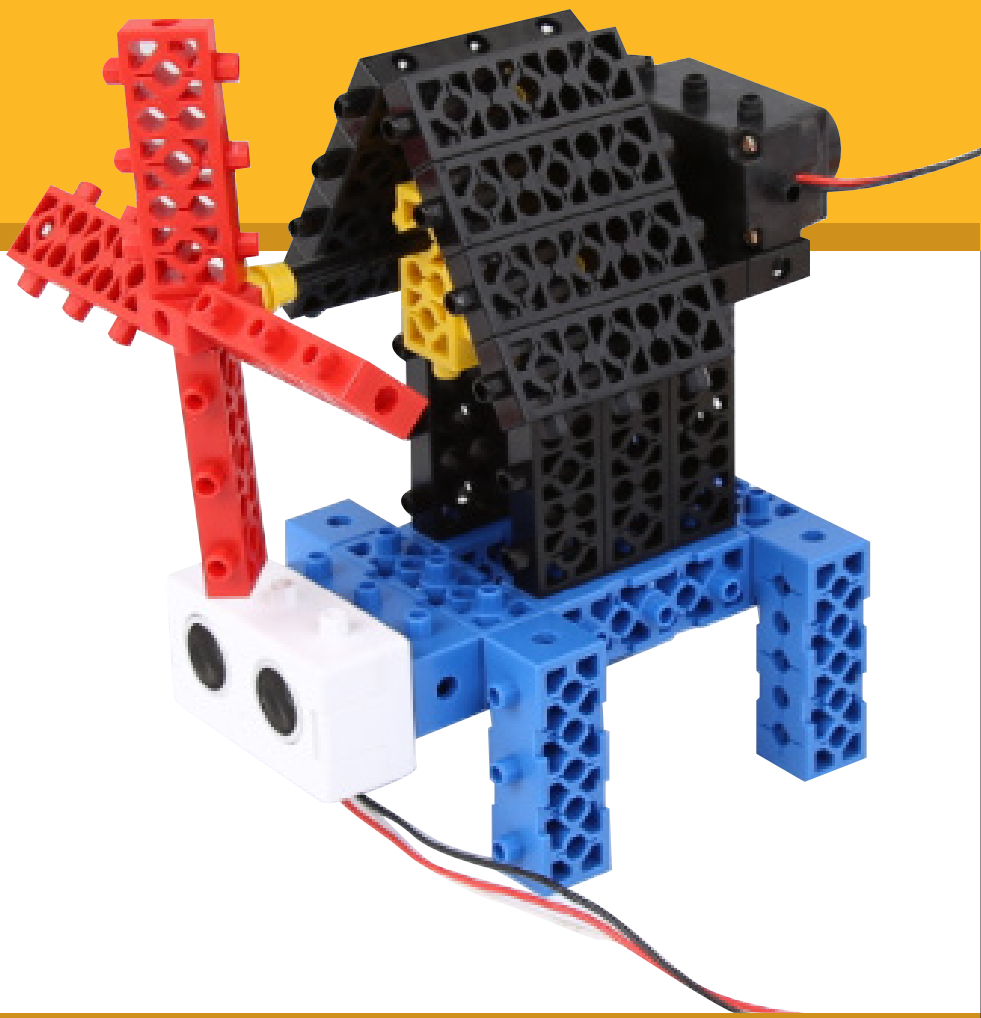


SCRATCH CODING KIT

Logic Boost

Ultrasonic Sensor

LESSON 6



Introduction

What is an Ultrasonic Sensor?

Now let's look at the ultrasonic sensors, one of the input sensors that measure distances. An ultrasonic sensor is a sensor that sends ultrasonic waves to a specific object and receives the reflected ultrasonic waves to detect the distance of the object. The value of the scratch input depends on the distance the ultrasonic sensor measures. If you input the value that varies according to the distance, you will be able to operate according to the ultrasonic sensor.

Side

Front

Above picture is the shape of the Robotori ultrasonic sensor. Find the ultrasound sensor among the Robotori products.

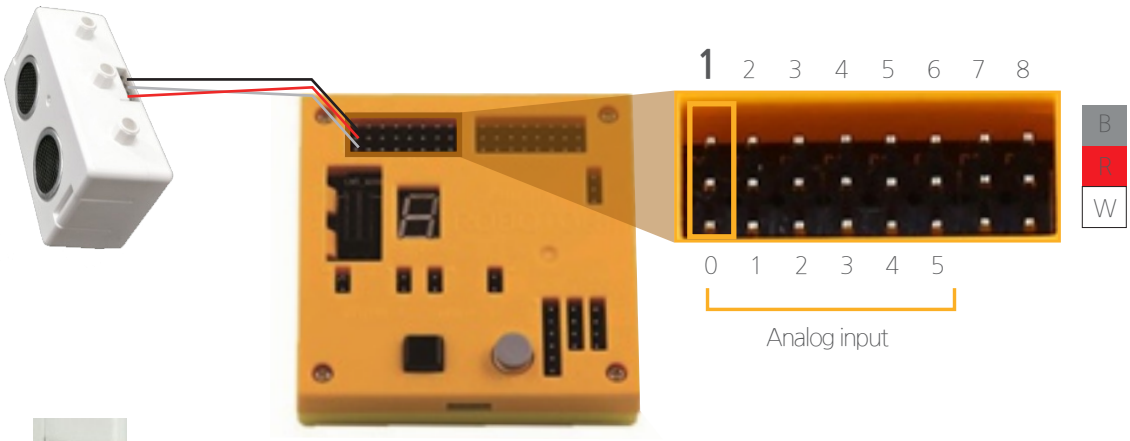
Now, let's see how the value is entered every time the ultrasonic sensor recognizes it.

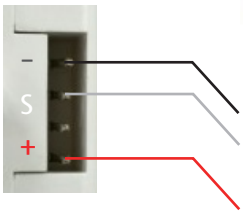
CLASS 3

Connecting the Main Cell

Connecting the ultrasonic sensor to the analog port.

Try connecting the ultrasonic sensor to the analog port of the motherboard.





"-" = Black
"S" = White
"+" = Red

Insert the ultrasonic sensor into the port and check the values below.

You can see that the value of Analog0 port changes on the screen. This is the analog value of the ultrasonic sensor.

Ultrasonic Sensor Coding Experience

Ultrasonic Sensor Analog Value

If you leave the ultrasonic sensor, you can see the value of "Analog0".

As you get closer to the ultrasonic sensor, you can see that the value of "Analog0" decreases

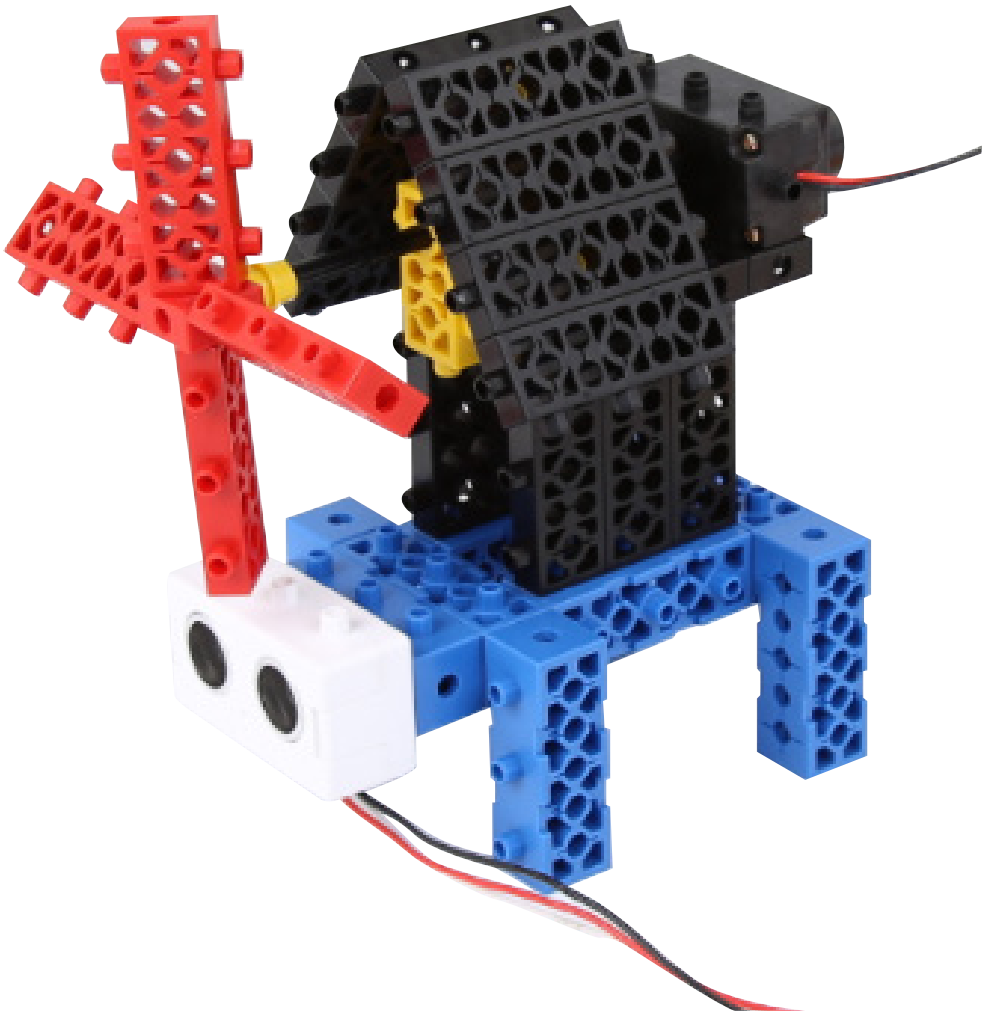
Unlike the sensors you learned earlier, ultrasonic sensors do not cover or press them by hand, but they use values based on distance, making it difficult to use them as digital values. Therefore, ultrasonic sensors are often used as analog values for distance. Confirm that the value gets lower when the distance between the ultrasonic sensor and the object is lower, and higher when the distance from the object is longer!

CLASS 3

Ultrasonic Sensor Coding Experience

Utilizing the Ultrasonic Sensor

Now let's see how we can apply an ultrasonic sensor to our program. First, we have to make our old friend, a mini windmill. Now you can make this model very quickly!



Ultrasonic Sensor Coding Experience

Using the Ultrasonic Sensor with the Mini Windmill

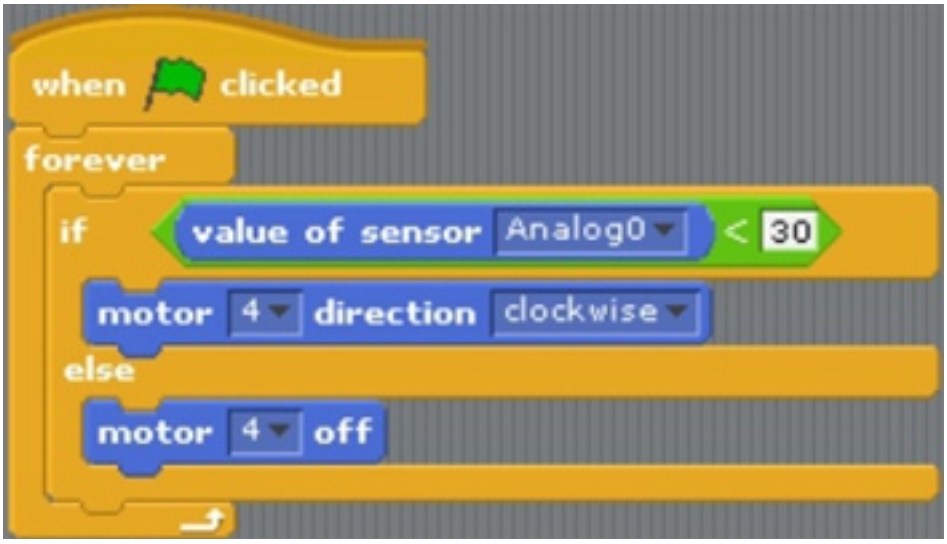
We will use ultrasonic sensors to operate the mini windmill. I will operate the mini windmill according to the distance between the ultrasonic sensor and the object. Code it so that when the distance approaches the windmill works, and stops if it goes away.

CLASS 3

Ultrasonic Sensor Coding Experience

Coding the mini windmill with ultrasonic sensor

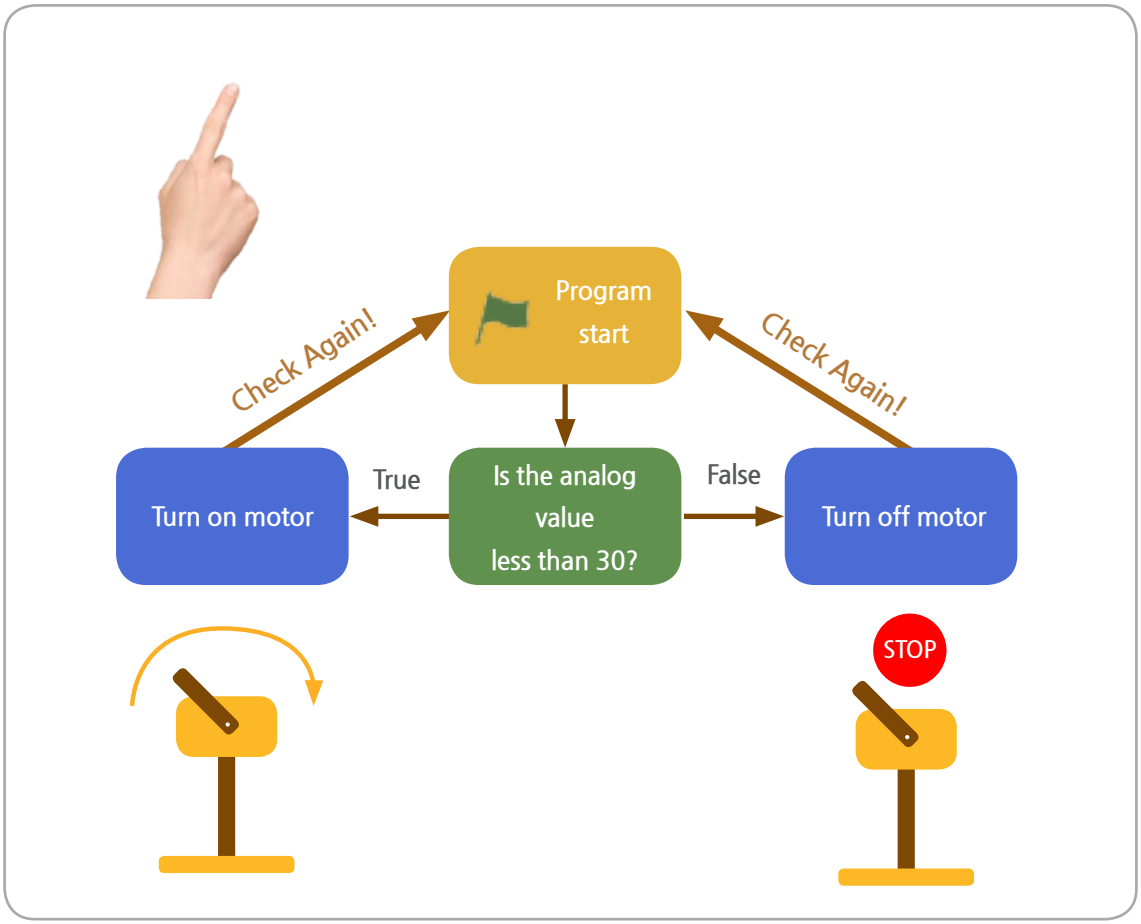
You have to set the distance standard to check the analog value of the ultrasonic sensor. Do you remember the threshold you learned at level 3? The mini windmill should work if you get the distance standard and closer to it, and the mini windmill should not work if it is farther than the standard. This will be the script below.



Ultrasonic Sensor Coding Experience

Coding the mini windmill with ultrasonic sensor

The flowchart should be exactly the same except for the condition.



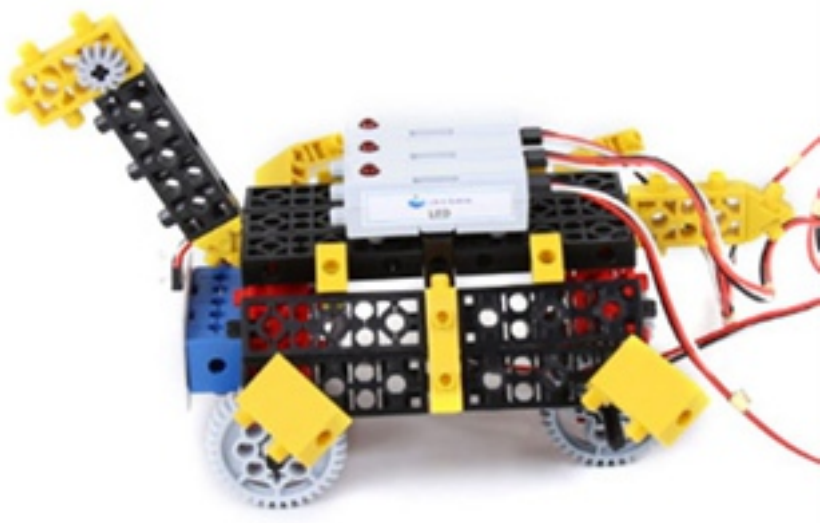
When you close the object to the ultrasonic sensor, the motor will turn on. Beyond the standard, the motor will turn off!

CLASS 3

Making a Robot

Ultrasonic Turtle

Now, using the LED sensor of the ultrasonic sensor, we will code to make the LED turn on as the distance changes. As the turtle moves away from the wall, there will be several LED sensors on the back. Let's set the turtle facing the wall and change the street.



Ultrasonic Turtle Materials

							
Rubi 8 x 2	Rubi 7 x 4	Rubi 4 x 4	Rubi 2 x 8	Rubi 0 x 2	Mini 2 x 4	Curve x 4	Triangle x 6
							
Sawtooth 12 x 2	Sawtooth 36 x 4	A 23 x 1	A 64 x 2	ULTRASONIC SENSOR x 1	LED SENSOR x 3	3pin connector x 4	4pin connector x 1

Making a Robot

Making an Ultrasonic Turtle

1 Make two of these

2

3

4

5 Combine figure 3 and figure 4

6

Make two of these

7

8 Make two of these

9

Combine figure 7 and figure 8

10

CLASS 3

Making a Robot

Coding the Ultrasonic Turtle

Ultrasonic turtles are the models that turn on multiple LED sensors as the distance increases. The number of LED sensors that are turned on depends on the analog reference value for each distance. Let's code it yourself!