

COLOUR SENSOR



Learning Goals

- Build knowledge about coding and robotics by coding a sensor and making a robot move.
- Read, debug, and alter code featuring conditional statements to use sensor input to determine how a robot should move.
- Have FUN learning!



COLOUR SENSOR

Do you need to review the Getting Started document?

Do you have the Robocar with the EV3 attached?
Is the EV3 turned on?

Is the LEGO EV3 Classroom app open and on screen?
Is the EV3 connected and ready to use?

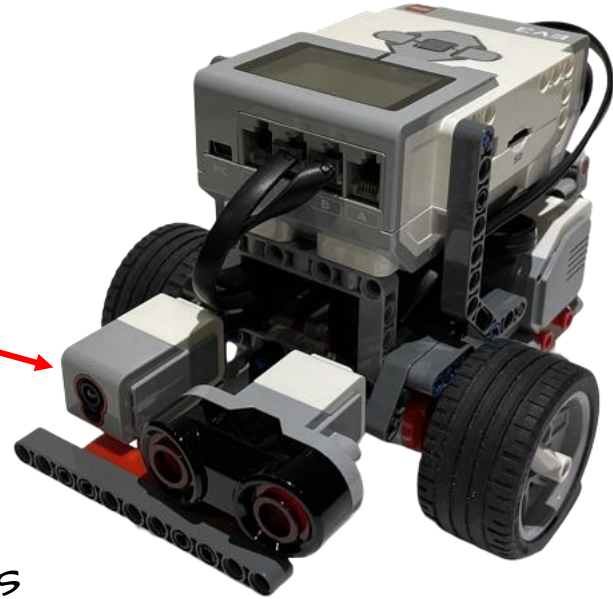
Do you know how to download programs to the EV3 and
select programs from the EV3?

Do you know how to move and steer the Robocar?



COLOUR SENSOR

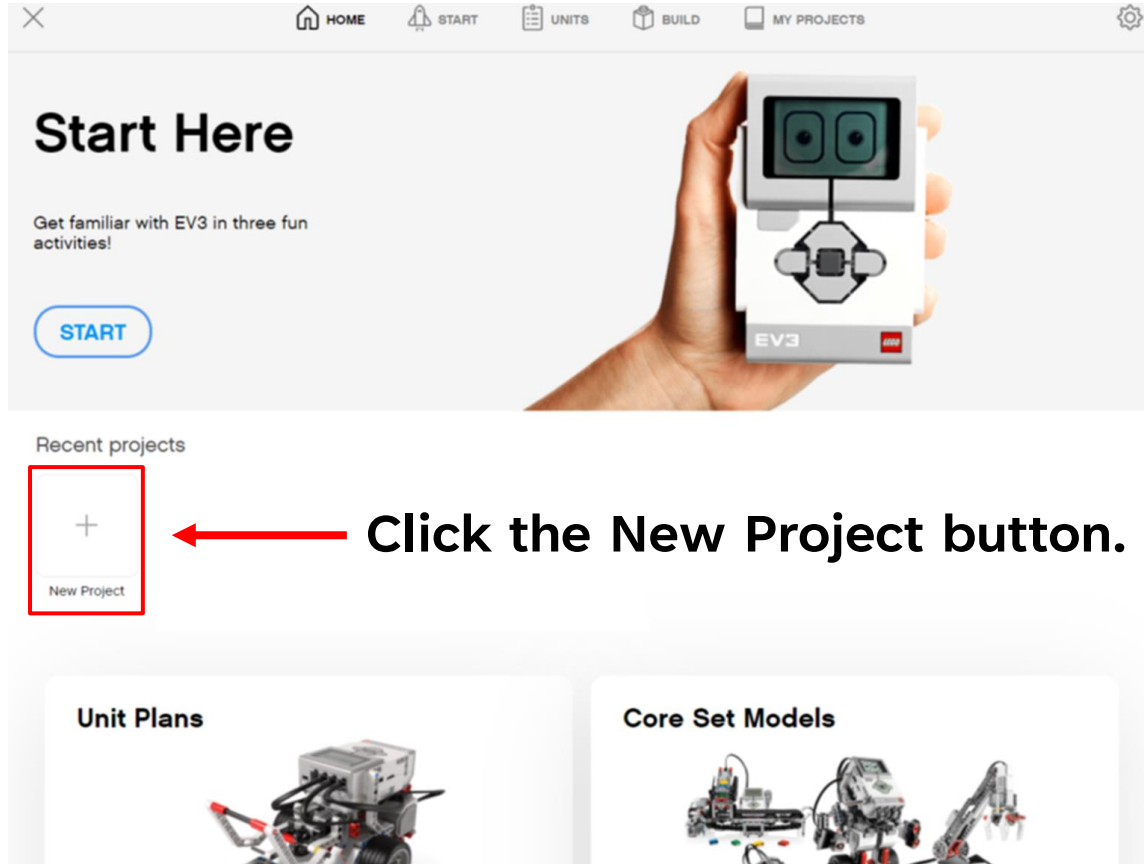
This is the LEGO EV3 colour sensor.



The colour sensor senses variances in light wavelengths to detect objects within the visible spectrum. As such it can be used to detect different colours. It has been set to automatically sync with the basic colours of the LEGO building system.



COLOUR SENSOR



The screenshot shows the LEGO EV3 software interface. At the top, there is a navigation bar with icons for HOME, START, UNITS, BUILD, and MY PROJECTS, along with a settings gear icon. The main content area features a large image of a hand holding a LEGO EV3 brick with a color sensor attached. Below this image, the text "Start Here" is displayed, followed by "Get familiar with EV3 in three fun activities!" and a blue "START" button. Underneath, the "Recent projects" section contains a "New Project" button, which is a square with a plus sign and the text "New Project" below it. A red arrow points to this button from the text "Click the New Project button." Below the "Recent projects" section, there are two categories: "Unit Plans" with a small image of a robot, and "Core Set Models" with a larger image of a robot.

Start Here

Get familiar with EV3 in three fun activities!

START

Recent projects

+
New Project

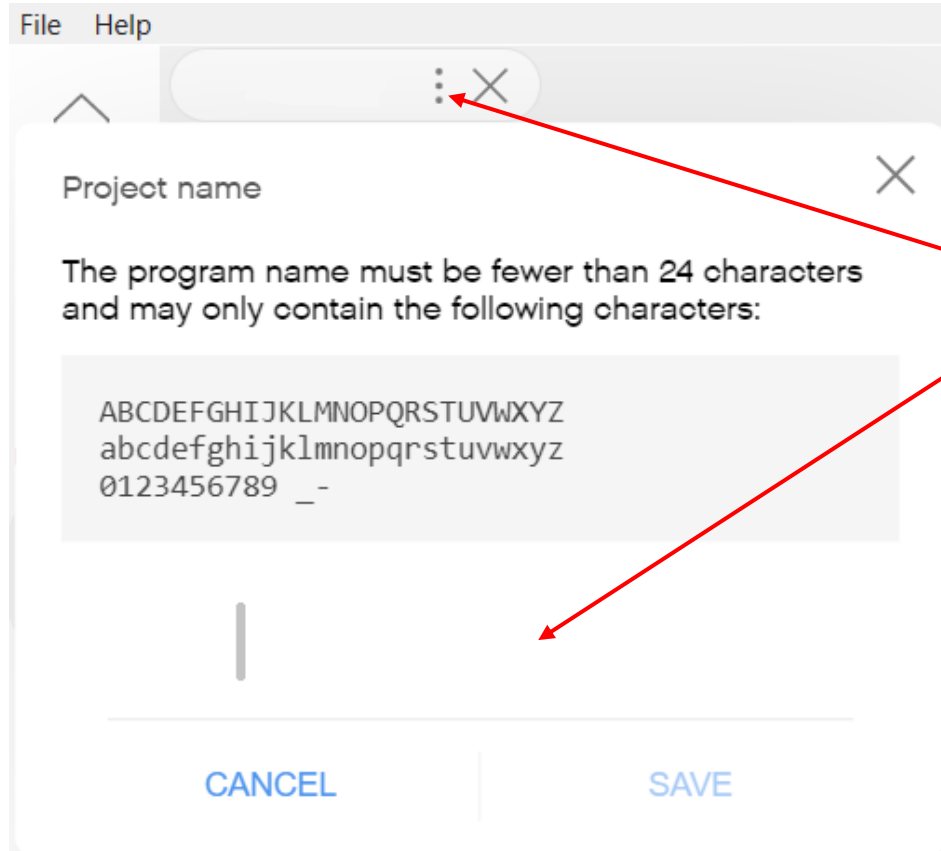
Click the New Project button.

Unit Plans

Core Set Models



COLOUR SENSOR



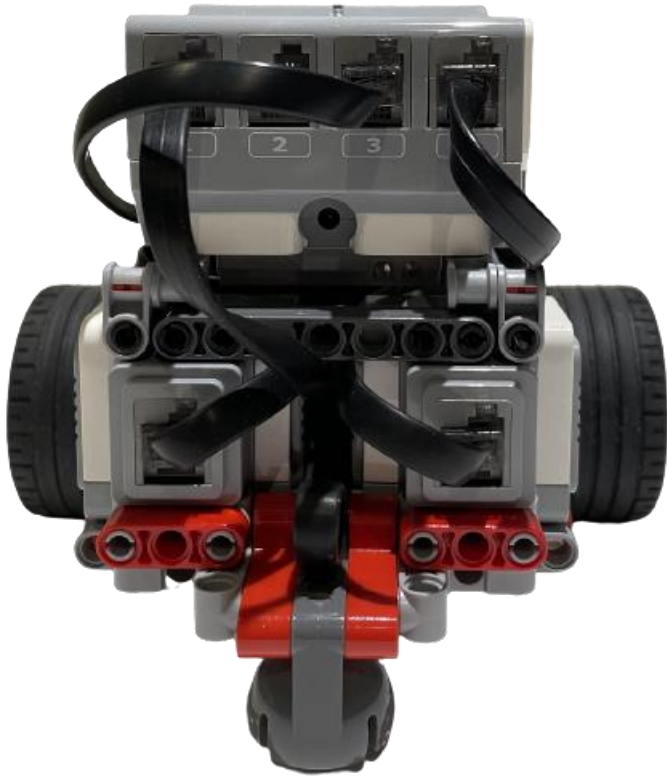
Name your program.

- Click the three dots.
- In the project name window type:

Colour- _____
(your names).



COLOUR SENSOR



The Robocar motors are connected to ports B and C. The distance sensor is connected to port 4, the colour sensor is connected to port 3, and the touch sensor is connected to port 1.

If for some reason any of these devices are not connected to the proper ports, please let Mr. Desmond know so that the proper adjustments can be made.



COLOUR SENSOR

Colour Sensor - Exploration 1

Activity Goals

- 1) To explore how to use the colour sensor to allow the robot to independently respond to environmental situations using input information from the sensor to direct robot actions.
- 2) To understand coding using the wait until conditional statement in combination with the colour sensor.



COLOUR SENSOR

Colour Sensor - Exploration 1

Activity Steps

- 1) Create the What Colour code sequence to test how the colour sensor works. [What Colour?](#)
- 2) Create the Colour Alert code sequence. [Colour Alert](#)
- 3) Learn about the if then else conditional statement.

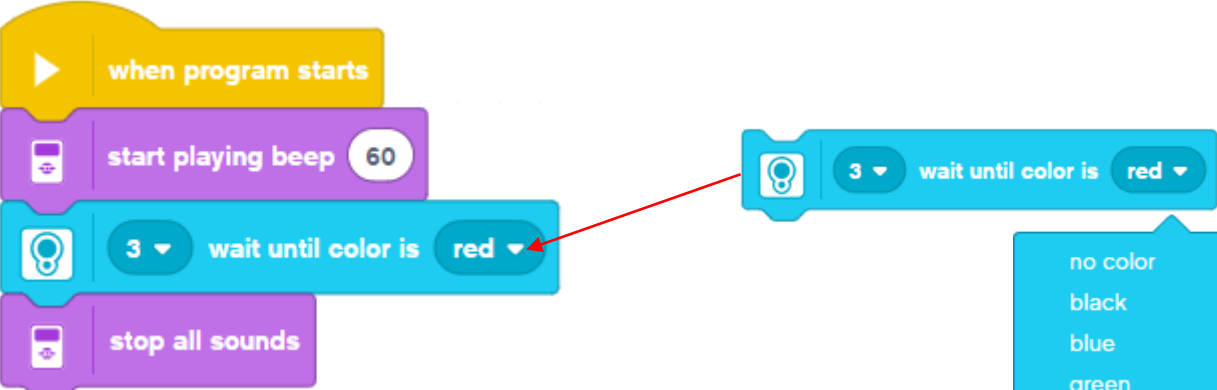
[Code Explained](#)

- 4) Learn about the colour sensor. [Colour Sensor](#)
- 5) Answer questions and explain your ideas. [Explain](#)

COLOUR SENSOR

Colour Sensor - Exploration 1 - What Colour?

Create this code sequence to have the Robocar use the colour sensor to sense different colours.



The image shows a sequence of four Scratch code blocks:

- when program starts** (yellow block)
- start playing beep** (purple block) with a duration of 60.
- wait until color is** (light blue block) with a wait time of 3 and the color set to **red**.
- stop all sounds** (purple block).

A red arrow points from the 'wait until color is' block in the second sequence to the 'wait until color is' block in the first sequence. A dropdown menu is open for the 'wait until color is' block in the first sequence, showing a list of color options:

- no color
- black
- blue
- green
- yellow
- ✓ red
- white
- brown
- changed

Download the program to the EV3.

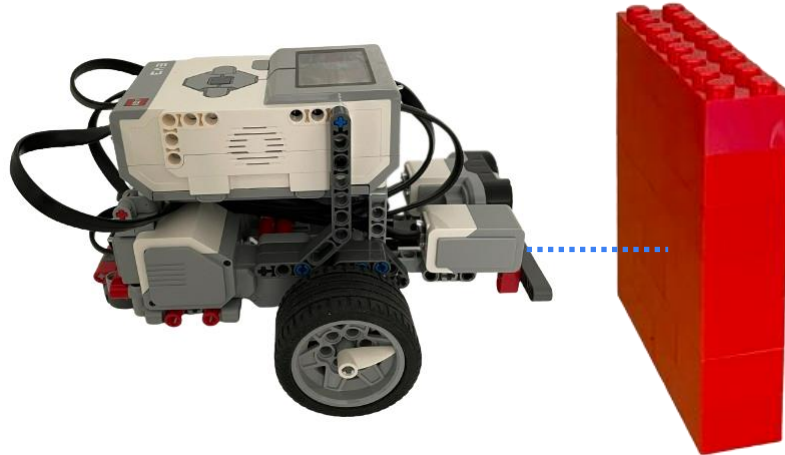


COLOUR SENSOR

Colour Sensor - Exploration 1 - What Colour?

Download and run the program four times using a different colour each time based on the colours of the available colour panels.

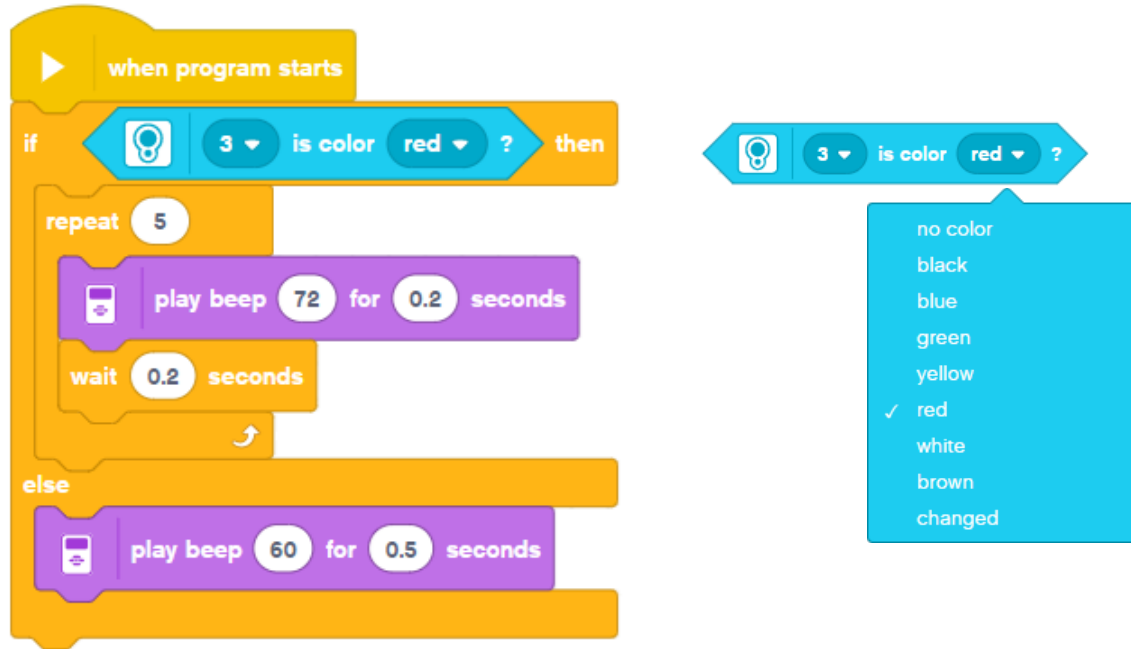
Have the Robocar use the colour sensor to sense each of the four different colours.



COLOUR SENSOR

Colour Sensor - Exploration 1 - Colour Alert

Create this code sequence to have the Robocar use the colour sensor to sense four different colours.



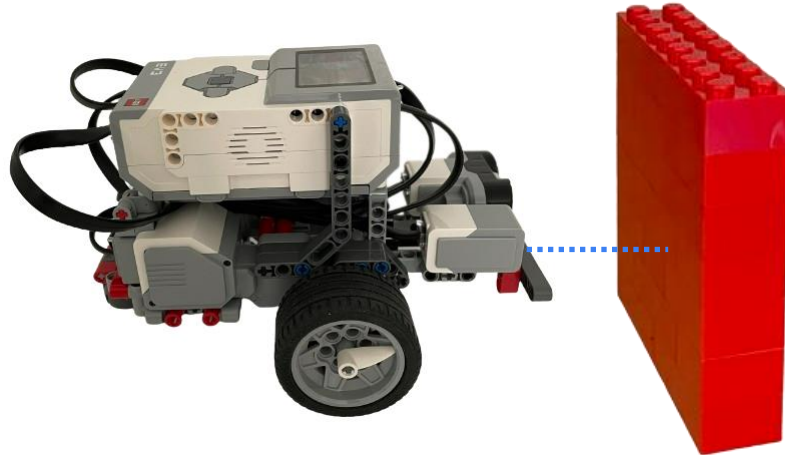
The image displays a Scratch code sequence for a color sensor. The code begins with a yellow 'when program starts' block. This is followed by an 'if' block with a lightbulb icon, containing a '3' in a dropdown menu, the text 'is color', a 'red' dropdown menu, and a question mark. The 'then' branch of the 'if' block contains a 'repeat' block with the number '5'. Inside the 'repeat' block, there is a 'play beep' block with '72' in a dropdown menu and '0.2' in a dropdown menu, followed by a 'wait' block with '0.2' in a dropdown menu. The 'else' branch of the 'if' block contains a 'play beep' block with '60' in a dropdown menu and '0.5' in a dropdown menu. To the right of the main code, there is a separate 'if' block with a lightbulb icon, a '3' in a dropdown menu, the text 'is color', a 'red' dropdown menu, and a question mark. A dropdown menu is open below this block, listing the following options: 'no color', 'black', 'blue', 'green', 'yellow', 'red' (with a checkmark), 'white', 'brown', and 'changed'. A blue arrow points to the right at the bottom right of the image.

COLOUR SENSOR

Colour Sensor - Exploration 1 - Colour Alert

Download and run the program four times using a different colour each time based on the colours of the available colour panels.

Have the Robocar use the colour sensor to sense each of the four different colours.



COLOUR SENSOR

Colour Sensor - Exploration 1

This conditional coding sequence uses the "if then else" condition.

"If then else" is basically a "is it true" question in action.

If you like vanilla ice cream [true] then you can ask for some or else [not true] you can ask for something different.

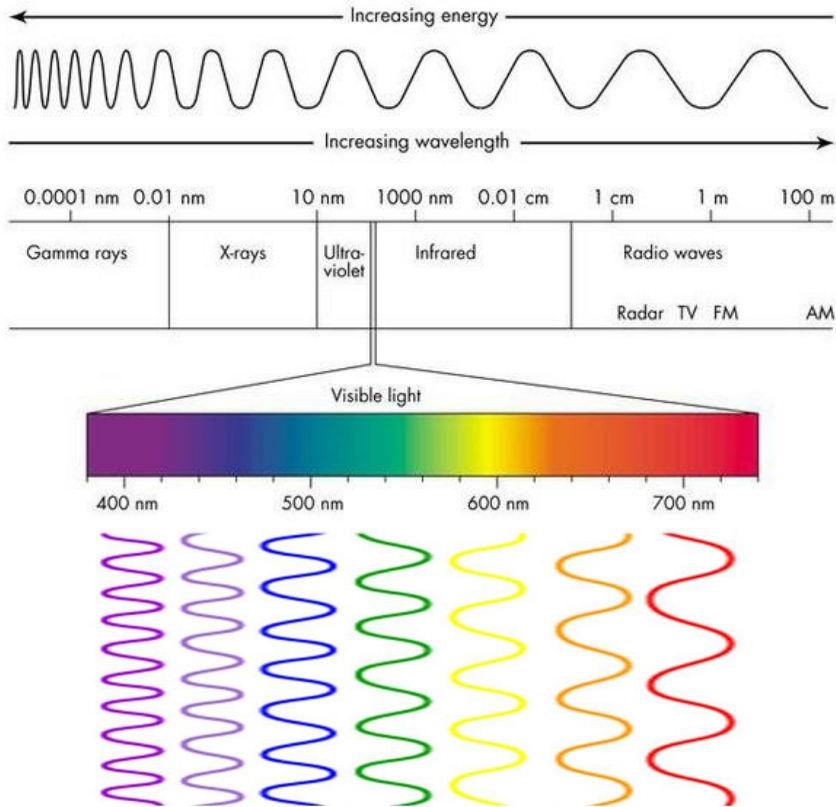
If true then do, or else do the other.

In this case if the colour of the object is red [true] then the higher pitch beep sound will play repeatedly, or else [not true] the lower pitch beep sound will play once.



COLOUR SENSOR

Colour Sensor - Consider This



With your eyes and your sense of sight you can see light and different colours.

Like your eyes the colour sensor is able to sense different colours by detecting differences in the wavelengths of reflected light.

Check out this video for more information about light and colour.

<https://www.youtube.com/watch?v=9Vsl0lom3S0>



COLOUR SENSOR

Colour Sensor - Exploration 1

Think about it, discuss your ideas as a group, and then write down your answer on a sheet of paper.

1) Explain how the colour sensor detects variances in the visible spectrum.

Show Mr. Desmond your answer.
Show Mr. Desmond your coding
and the robot in action using the
colour sensor to sense different
colours. Be prepared to explain what
is happening with the colour sensor and why.



COLOUR SENSOR

Colour Sensor - Exploration 2

Activity Goals

- 1) To explore how to use the colour sensor to allow the robot to independently respond to environmental situations using input information from the sensor to direct robot actions.
- 2) To demonstrate precision of movement of the robot while using the colour sensor.
- 3) To understand coding using conditional statements in combination with the colour sensor.



COLOUR SENSOR

Colour Sensor - Exploration 2

Activity Steps

- 1) Create the Go There code sequence to move the Robocar and test the colour sensor. [Go There](#)
- 2) Create the Go There Again code sequence. [Go There Again](#)
- 3) Create the Go There and Turn code sequence.
[Go There and Turn](#)
- 4) Answer questions and explain your ideas. [Explain](#)

COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There

Create a code sequence to have the Robocar move toward an object that is green in colour and use the colour sensor to stop the Robocar when it senses the object.



COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There

Download the program to the EV3.

Run the program from the EV3.

Observe how the Robocar moves.



COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There Again

Create a code sequence to have the Robocar move toward an object that is green in colour and use the colour sensor to stop the Robocar when it senses the object.



```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color green ? then
      stop moving
      stop this stack
```



COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There Again

Download the program to the EV3.

Run the program from the EV3.

Observe how the Robocar moves.



Compare this code sequence using the "if then" condition to the code sequence you created that uses the "wait until" condition.

```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color green ? then
      stop moving
    stop this stack
```



COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There and Turn

Create a code sequence using the "if then" condition to have the Robocar move toward an object of a certain colour (choose a different colour panel than green). Use the colour sensor to stop the Robocar when it senses the object. Then have the Robocar move backward and turn 90° to the left.



COLOUR SENSOR

Colour Sensor - Exploration 2 - Go There and Turn

Download the program to the EV3.

Run the program from the EV3.

Observe how the Robocar moves
and modify the program as needed.



COLOUR SENSOR

Colour Sensor - Exploration 2

Show Mr. Desmond your "if then" coding and the Robocar in action using the colour sensor to sense an object of a certain colour.

Be prepared to explain what is happening with the colour sensor and why.



COLOUR SENSOR

Colour Sensor - Exploration 2

Think about it, discuss your ideas as a group, and then write down your answers on a sheet of paper.



- 1) How are these two code sequences the same?
- 2) How are these two code sequences different?

```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  start moving straight: 0
  3 wait until color is green
  stop moving
```

```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color green? then
      stop moving
      stop this stack
  stop this stack
```



COLOUR SENSOR

Colour Sensor - Exploration 2

Think about it, discuss your ideas as a group, and then write down your answer on a sheet of paper.

3) Why are conditional statements like "wait until" and "if then" paired with sensors?

Show Mr. Desmond your answers and be prepared to explain your ideas.



COLOUR SENSOR

Colour Sensor - Exploration 3

Activity Goals

- 1) To explore how to use the colour sensor to allow the robot to independently respond to environmental situations using input information from the sensor to direct robot actions.
- 2) To demonstrate precision of movement of the robot while using the colour sensor and a repeat block.
- 3) To understand coding using conditional statements in combination with the colour sensor.



COLOUR SENSOR

Colour Sensor - Exploration 3

Activity Steps

- 1) Create the Ping-Pong code sequence to move the Robocar between two objects and test the colour sensor. [Ping-Pong](#)
- 2) Learn about nested if then else conditional statements.

[Code Explained](#)

- 3) Demonstrate your Ping-Pong code in action. [Demonstrate](#)
- 4) Answer questions and explain your ideas. [Explain](#)

COLOUR SENSOR

Colour Sensor - Exploration 3 - Ping-Pong

Create this code sequence to make the Robocar go back forth between two different coloured objects repeatedly using input from the colour sensor to determine when to turn around.

You do not have to use red, blue, and green objects as shown in the code sequence. You may choose which colour objects you will use and in what order.

See next page for a close-up view of the code sequence.

```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color red ? then
      stop moving
      move backward for ? seconds
      move right: 60 for ? seconds
    else
      if 3 is color blue ? then
        stop moving
        move backward for ? seconds
        move right: 60 for ? seconds
      else
        if 3 is color green ? then
          stop moving
          stop this stack
```

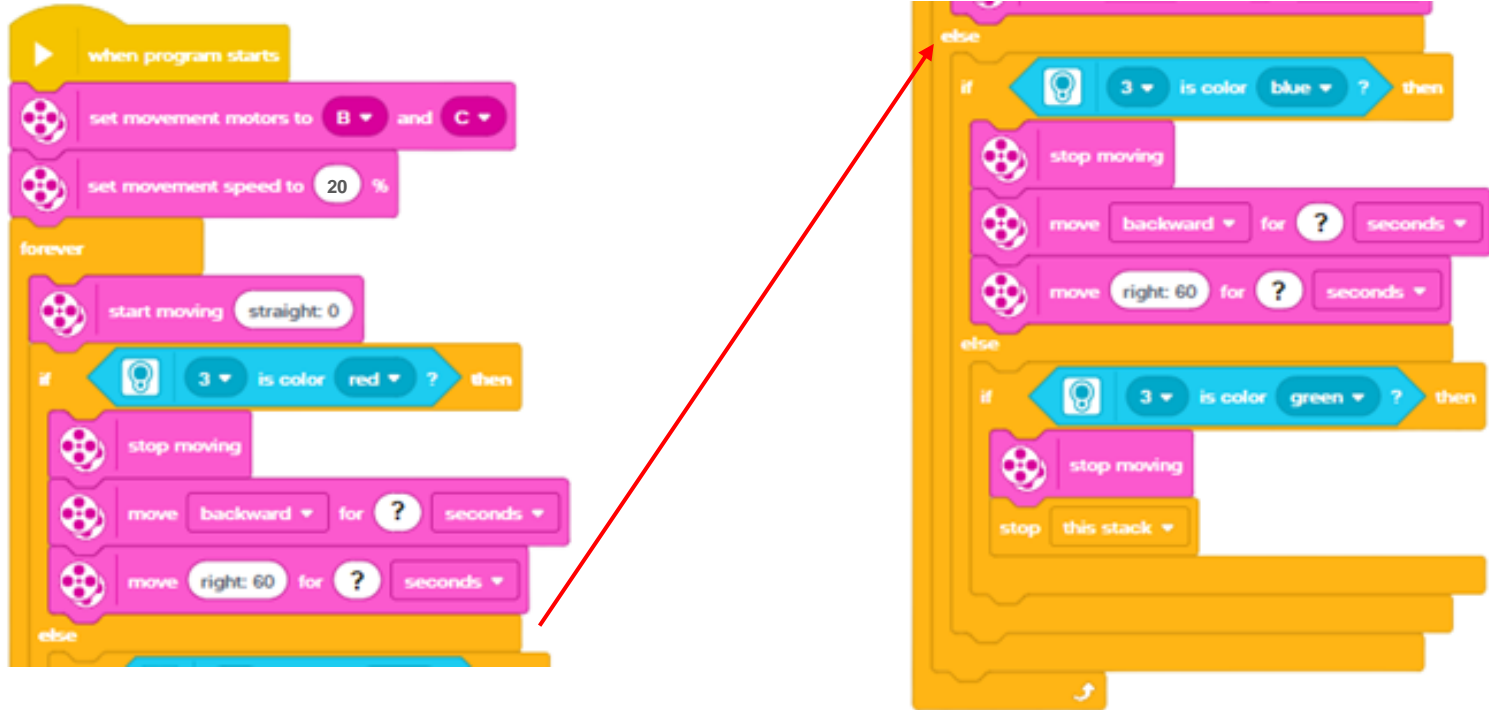
The code sequence is as follows:

- when program starts
 - set movement motors to B and C
 - set movement speed to 20 %
- forever
 - start moving straight: 0
 - if 3 is color red ? then
 - stop moving
 - move backward for ? seconds
 - move right: 60 for ? seconds
 - else
 - if 3 is color blue ? then
 - stop moving
 - move backward for ? seconds
 - move right: 60 for ? seconds
 - else
 - if 3 is color green ? then
 - stop moving
 - stop this stack



COLOUR SENSOR

Colour Sensor - Exploration 3 - Ping-Pong

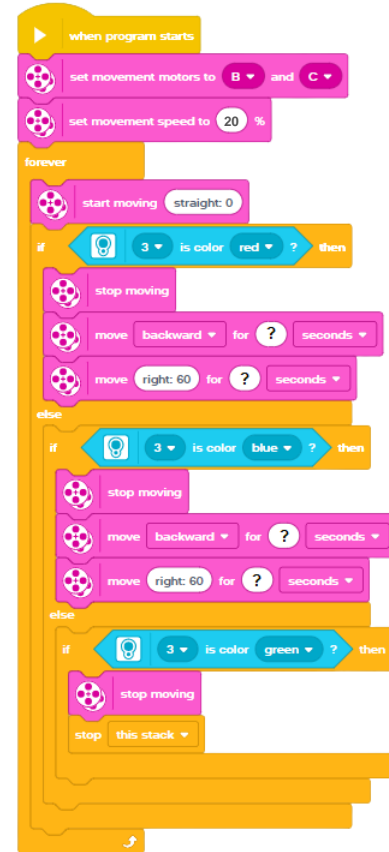


COLOUR SENSOR

Colour Sensor - Exploration 3 - Ping-Pong

The move backward for ? seconds block and move right 60 for ? seconds block will need to be adjusted. It is up to you to determine how much time is necessary to move backward and to turn. The turn may need to be a left turn rather than a right turn.

Notice that to stop the ping-pong action of the Robocar going back and forth between two coloured objects, a third coloured object needs to be placed in the path of the Robocar.



```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color red ? then
      stop moving
      move backward for ? seconds
      move right: 60 for ? seconds
    else
      if 3 is color blue ? then
        stop moving
        move backward for ? seconds
        move right: 60 for ? seconds
      else
        if 3 is color green ? then
          stop moving
          stop this stack
```



COLOUR SENSOR

Colour Sensor - Exploration 3 - Ping-Pong

Download the program to the EV3.

Run the program from the EV3.

Observe how the Robocar moves and modify the program as needed.



Precision of movement must be demonstrated. Keep the Robocar as straight as possible. The Robocar must not veer too far in different directions after each turn.

```
when program starts
  set movement motors to B and C
  set movement speed to 20 %
  forever
    start moving straight: 0
    if 3 is color red ? then
      stop moving
      move backward for ? seconds
      move right: 60 for ? seconds
    else
      if 3 is color blue ? then
        stop moving
        move backward for ? seconds
        move right: 60 for ? seconds
      else
        if 3 is color green ? then
          stop moving
          stop this stack
```



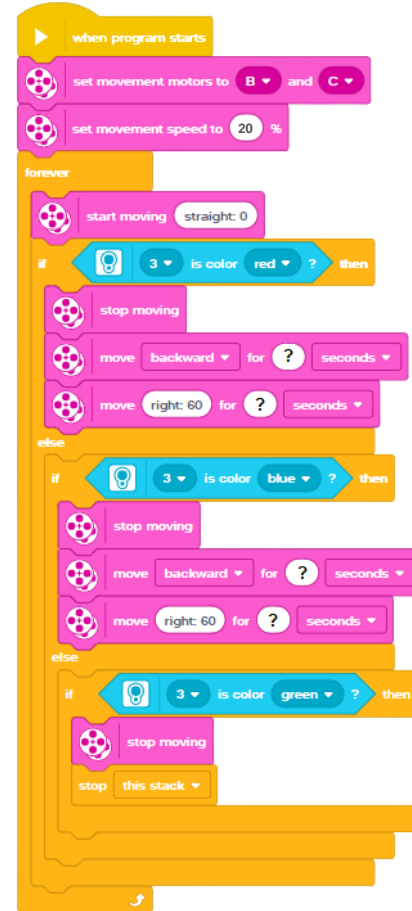
COLOUR SENSOR

Colour Sensor - Exploration 3 - Ping-Pong

This conditional coding sequence has an "if then else" condition inside an "if then else" condition.

That means that there are multiple related "is it true" questions in action.

If you like vanilla ice cream [true] then you can ask for some or else [not true] if you like chocolate ice cream [true] then you can ask for some or else [not true] you can ask for something different.



COLOUR SENSOR

Colour Sensor - Exploration 3

Show Mr. Desmond your coding and the robot in action using the colour sensor to repeatedly change direction of the Robocar when it senses certain colour objects.

Be prepared to explain what is happening with the colour sensor and why.



COLOUR SENSOR

Colour Sensor - Exploration 3

Think about it, discuss your ideas as a group, and then write down your answers on a sheet of paper.



- 1) What does "if then" mean and "if then else" mean?
- 2) What is the purpose of putting the "if then else" blocks inside a forever loop?
- 3) Why is it necessary to move backward before turning?

Show Mr. Desmond your answers and be prepared to explain your ideas.



COLOUR SENSOR

Colour Sensor - Consider This




A sensor is designed to provide input information to the robotic system. As a form of artificial intelligence (AI) the robot will respond to the environmental circumstances noted by the sensor and take specific actions in response.

The coding provides the robotic system the ability to perform this feat of machine intelligence. Conditional statements are essentially true or false questions that provide the logic that allows the robot to read the sensor input and then make a decision (according to the code) based on what the information was.



COLOUR SENSOR CHALLENGE

Learning Goals

-  Build knowledge about coding and robotics by coding a sensor and making a robot move.
-  Independently create code featuring conditional statements to use sensor input to determine how a robot should move.
-  Have FUN learning!



COLOUR SENSOR CHALLENGE

AMAZing Colour Sensor Challenge!

Create a maze of your own design using coloured panels. Create the code that will allow the Robocar to independently navigate the maze using the colour sensor to determine when to stop moving and turn.

You are expected to demonstrate your success to Mr. Desmond. Be prepared to show both the Robocar in action and your code.

*Placement of maze colour panels must allow space for the Robocar to move forward and backward as well as to turn.

