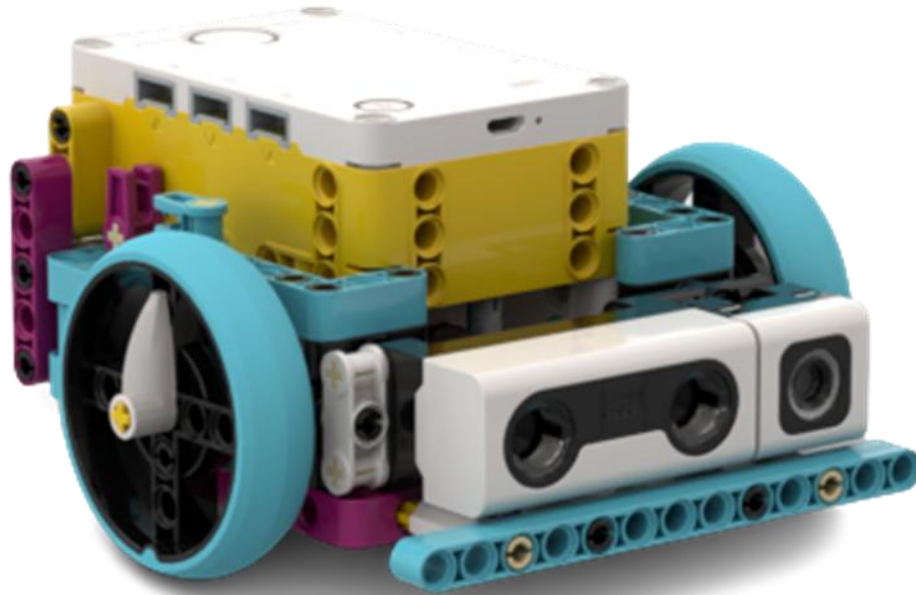


DISTANCE SENSOR



Distance Sensor Unit Activities

Introducing the distance sensor. [Distance Sensor](#)

Explore how to use the distance sensor. [Exploration 1](#)

More distance sensor exploration. [Exploration 2](#)

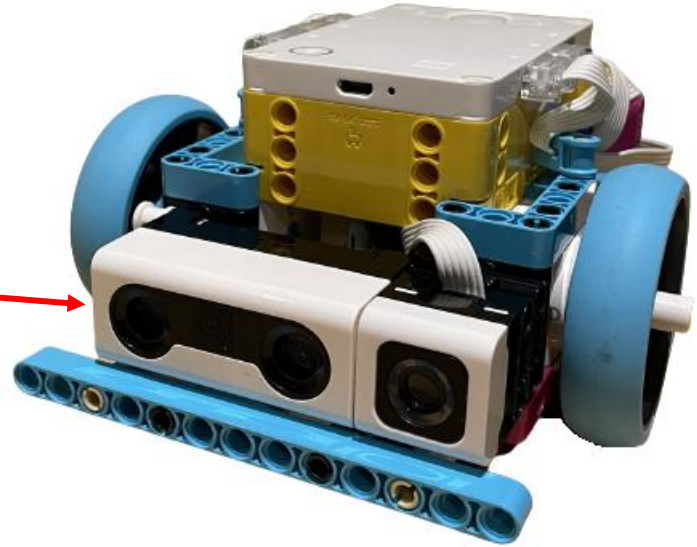
Distance sensor Ping-Pong Challenge. [Challenge 1](#)

Ping-Pong Count Challenge. [Challenge 2](#)

Distance sensor Amazing Challenge. [Challenge 3](#)

DISTANCE SENSOR

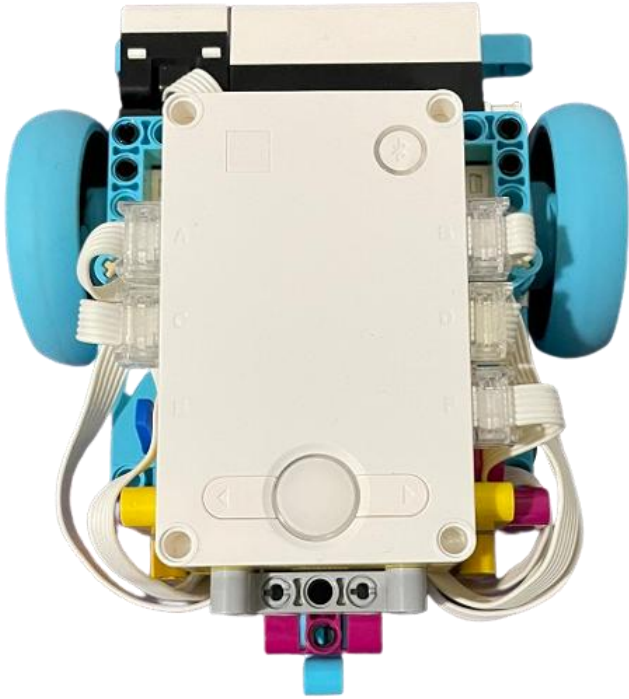
This is the LEGO distance sensor.



The distance sensor uses ultrasonic sound frequencies to detect objects and determine their distance in the same way that some animals use echo-location.



DISTANCE SENSOR



The Robocar motors are connected to ports A and B. The distance sensor is connected to port D and the force sensor is connected to port F.

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.



DISTANCE SENSOR

LEGO Education SPIKE - 2.0.6

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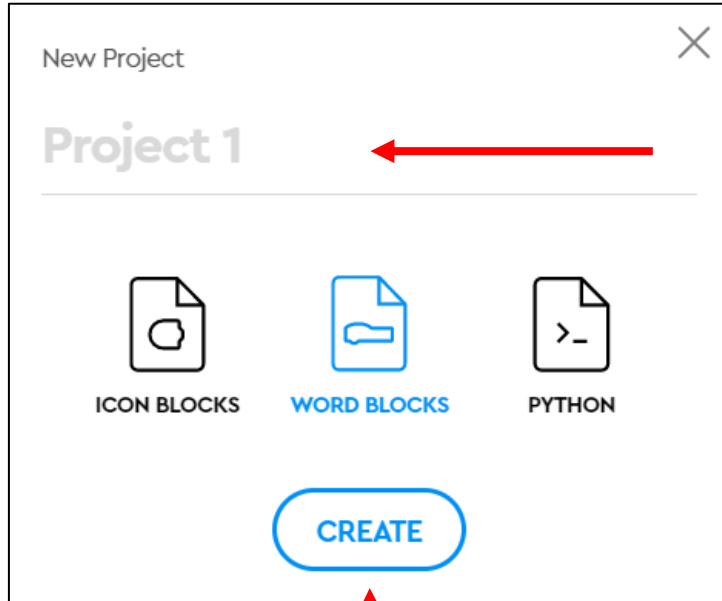
Click the New Project button.

Unit Plans

Building Instructions



DISTANCE SENSOR



Click **WORD BLOCKS** and then the **CREATE** button.

OR



Name your program.
Click the three dots
OR click in the
New Project window.

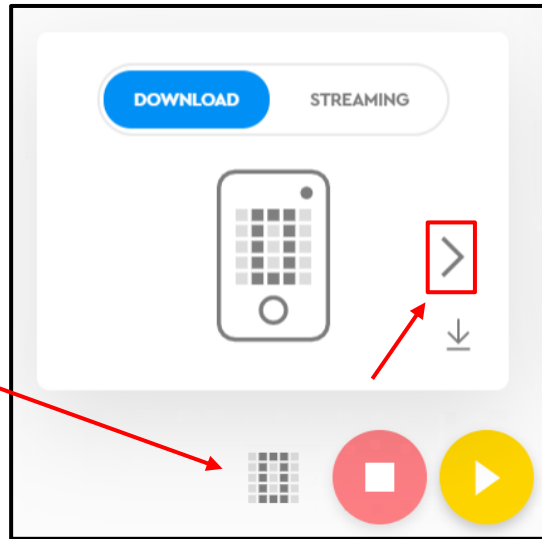
Name your project:

Distance- _____
(your names).

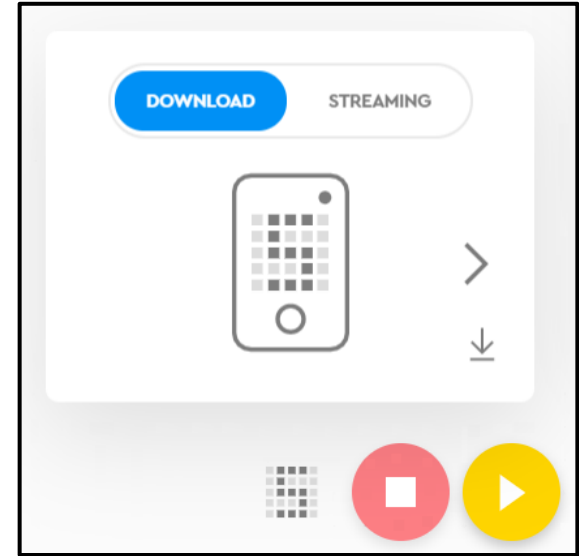


DISTANCE SENSOR

Click the program memory slot button.



Change the program memory slot to five.



Activity Goals

- 1) To explore how to use the distance 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 distance sensor.
- 3) To understand coding using the wait until conditional statement in combination with the distance sensor.

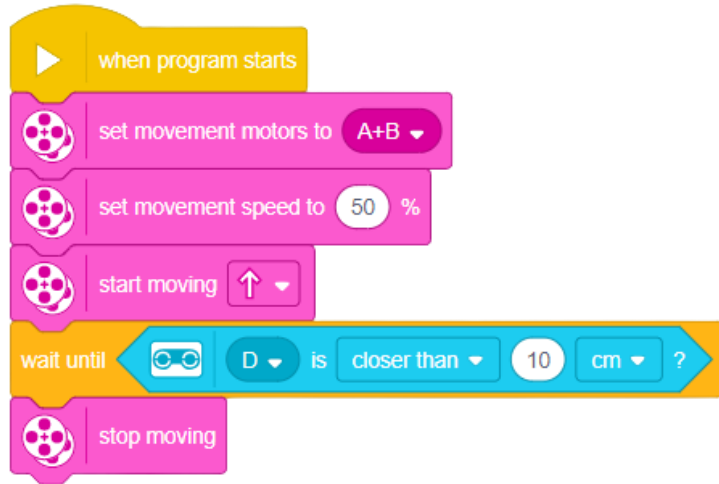


Activity Steps

- 1) Create a code sequence to move the Robocar and test how the distance sensor works. [Go There](#)
- 2) Learn about the wait until conditional statement.
[Code Explained](#)
- 3) Explore how to use the distance sensor. [Sense and Turn](#)
- 4) Answer questions and explain your ideas. [Explain](#)

DISTANCE SENSOR – GO THERE

Create a code sequence to have the Robocar move toward a large wooden block and use the distance sensor to stop 10 cm from the block.



Download the program to Spike.

Run the program from Spike.

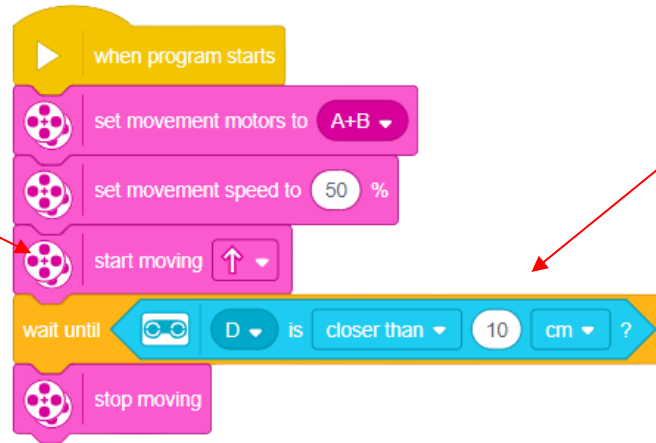
Observe how the Robocar moves.



DISTANCE SENSOR – CODE EXPLAINED

The “wait until” command is a conditional statement that monitors what the distance sensor is doing. The “wait until” code block allows the commands prior to it to perform until the distance sensor senses an object a specified distance in front of it. Only then will the coding sequence continue.

This means move – the duration is not defined. The duration is unlimited: it could be any value value above zero to infinity.



The “wait until” condition is equivalent to saying “always check to see if the distance sensor senses an object closer than 10 cm to it, if true then run the next command”.



DISTANCE SENSOR – SENSE AND TURN

Modify your code to have the Robocar move toward an object and use the distance sensor to stop 5 cm from the object. Have Spike move backward and then complete a 180° turn.



Download the program to Spike.
Run the program from Spike.
Observe how the Robocar moves.



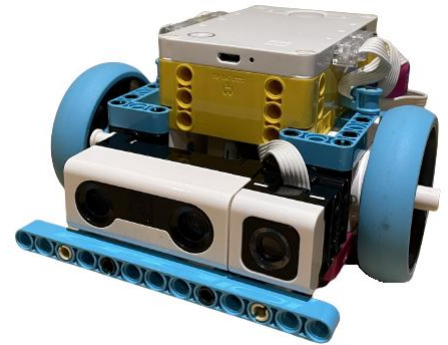
DISTANCE SENSOR – EXPLORATION 1

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

1) How does the distance sensor function?

Show Mr. Desmond your code and the Robocar in action using the distance sensor to stop the Robocar within a certain distance of an object.

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



Activity Goals

- 1) To explore how to use the distance 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 distance sensor.
- 3) To understand coding using the if then conditional statement in combination with the distance sensor.



Activity Steps

- 1) Create a code sequence to explore how to use the distance sensor. [Go There Again](#)
- 2) Learn about if then conditional statements. [Code Explained](#)
- 3) Explore more about how to use the distance sensor.
[Go There and Spin](#)
- 4) Answer questions and explain your ideas. [Explain](#)

DISTANCE SENSOR – GO THERE AGAIN

Create a code sequence to have the Robocar move toward a large wood block and use the distance sensor to stop 10 cm from the object.

Download the program to Spike.

Run the program from Spike.

Observe how the Robocar moves.



```
when program starts
  set movement motors to A+B
  set movement speed to 50 %
  forever
    start moving ↑
    if D is closer than 10 cm ? then
      stop moving
      stop this stack
```



DISTANCE SENSOR – CODE EXPLAINED

“If then” is a conditional statement. Without thinking about it you use it all the time.

If my hands are dirty, then I will wash them.

If I am cold, then I will put on a coat.

In this code sequence if the distance sensor senses an object closer than 10 cm then the motors will stop moving.

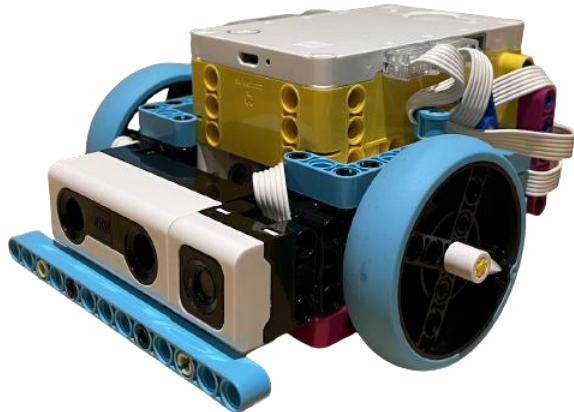
```
when program starts
  set movement motors to A+B
  set movement speed to 50 %
  forever loop
    start moving ↑
    if D is closer than 10 cm ? then
      stop moving
      stop this stack
```

The code sequence starts with a yellow 'when program starts' block. It is followed by two pink blocks: 'set movement motors to A+B' and 'set movement speed to 50 %'. These are followed by a yellow 'forever' loop block. Inside the loop, there is a pink 'start moving' block with an upward arrow. Below that is a blue 'if' block with a camera icon, 'D' selected, 'is closer than', '10', 'cm', and a question mark. The 'then' part of the 'if' block contains two pink blocks: 'stop moving' and 'stop this stack'.



DISTANCE SENSOR – GO THERE AND SPIN

Create a code sequence using the “if then” condition to have the Robocar move toward an object and use the distance sensor to stop 5 cm from the object. After the stop have the Robocar move backward and then complete a fun robot spin maneuver.



Download the program to Spike.

Run the program from Spike.

Observe how the Robocar moves.



DISTANCE 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 A+B
  set movement speed to 50%
  start moving ↑
  wait until D is closer than 10 cm
  stop moving
```

```
when program starts
  set movement motors to A+B
  set movement speed to 50%
  forever
    start moving ↑
    if D is closer than 10 cm then
      stop moving
      stop this stack
```



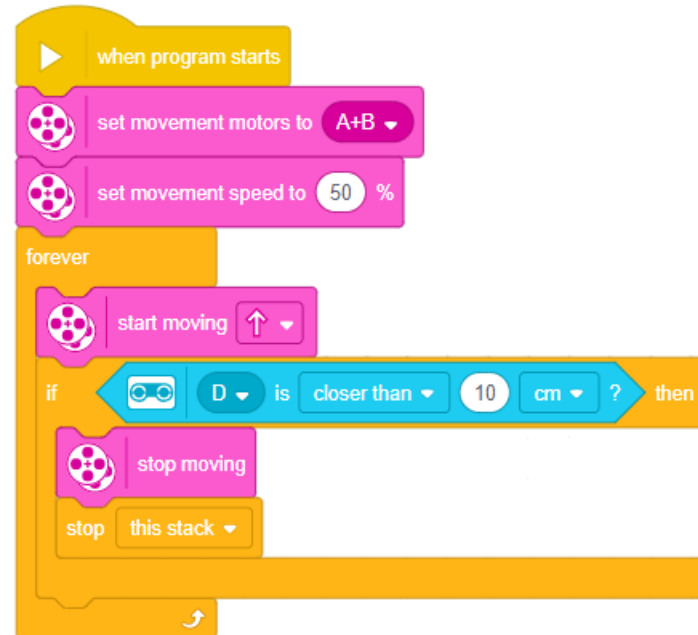
DISTANCE SENSOR – EXPLORATION 2

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



3) What is the purpose of the “forever” block?

4) What is the purpose of the “stop this stack” block?



DISTANCE SENSOR – EXPLORATION 2

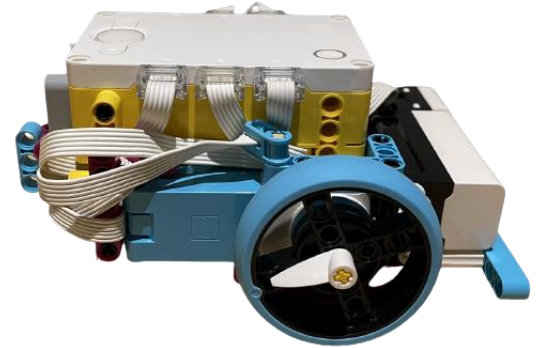
Think about it, discuss your ideas as a group, and then write down your answer on a sheet of paper.



5) Why are conditional statements like “wait until” and “if then” paired with sensors?

Show Mr. Desmond your “if then” code and the Robocar in action.

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



Activity Goals

- 1) To explore how to use the distance sensor to allow the robot to independently respond to environmental situations using input information from the sensor to direct robot actions.
- 2) To deepen understanding of how to use conditional statements in combination with the distance sensor.



DISTANCE SENSOR – PING-PONG CHALLENGE

Create a code sequence to make the Robocar go back and forth between two wooden blocks four times using input from the distance sensor to determine when to turn around.



Pair the distance sensor with either the “wait until” condition or the “if then” condition in your coding.

Keep the wood blocks about 50 cm apart.

Precision of movement is required to keep the Robocar as straight as possible and not veer in different directions after each turn.

Show Mr. Desmond your “ping-pong” coding and the Robocar in action. Be prepared to explain what is happening and why.

DISTANCE SENSOR – PING-PONG COUNT CHALLENGE

Modify your code from the Ping-Pong Challenge.

Create a variable called count.

Have the Robocar count each time the distance sensor sense one of the blocks.

Include the count as part of the conditional coding as the Robocar “ping-pongs” back and forth between the two wooden blocks.

Have the Robocar continue to move between the two wooden blocks until the count has reached nine.

Show Mr. Desmond your code and the Robocar in action. Be prepared to explain what is happening and why.



DISTANCE SENSOR – AMAZING CHALLENGE

Create a maze of your own design using blocks or other solid objects. [Do not make it overly complex.] Create the code that will allow the Robocar to independently navigate the maze using the distance 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 blocks must allow ample space for the Robocar to move forward and backward as well as to turn.