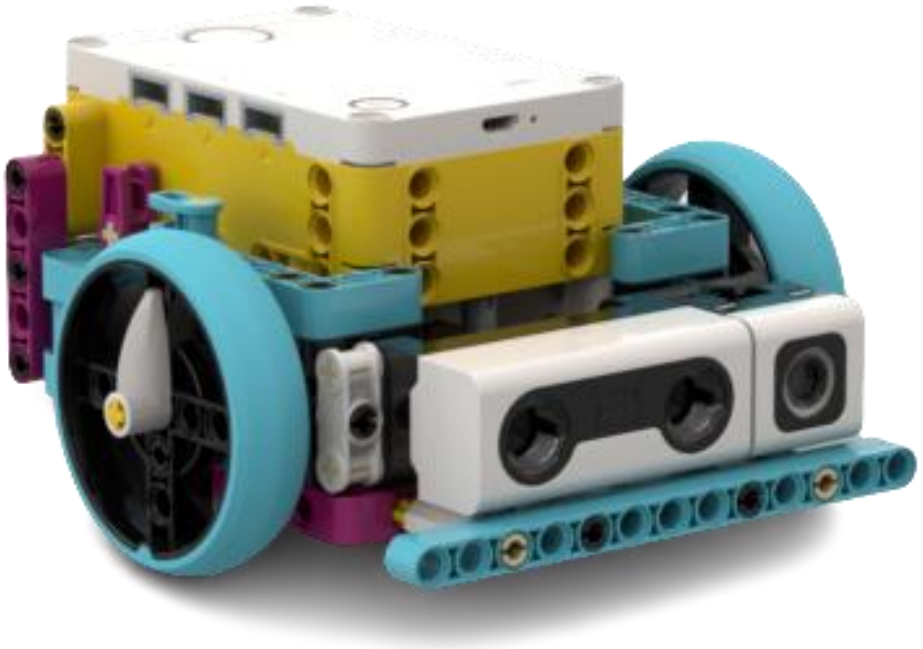
Movement



Movement

Learning Goals

- Build knowledge about coding and robotics by coding a robot to make it move.
- Read, debug, and alter code to make a robot move forward and backward.
- Have FUN learning!

Movement

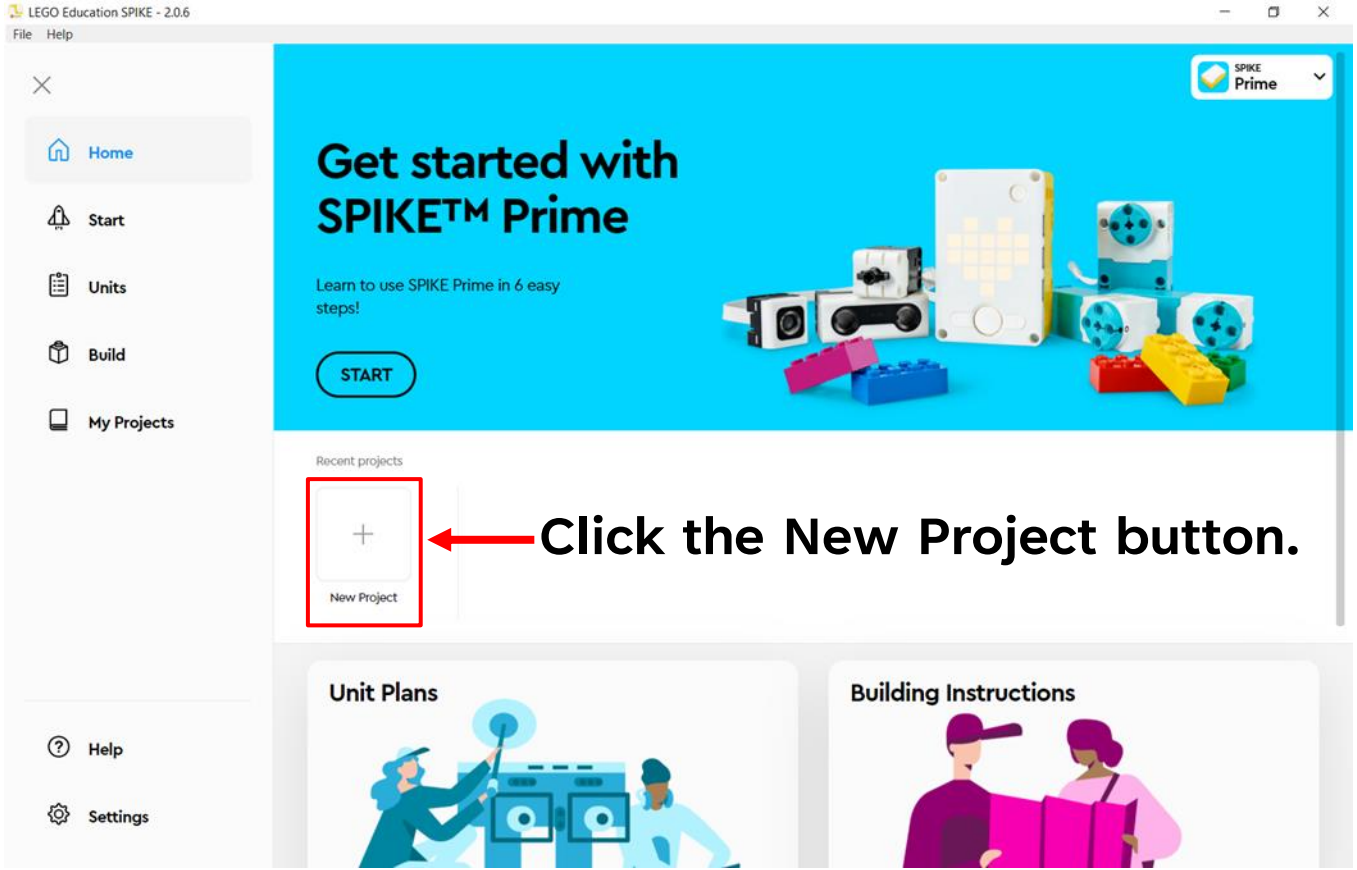
Did you review the Getting Started document?

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

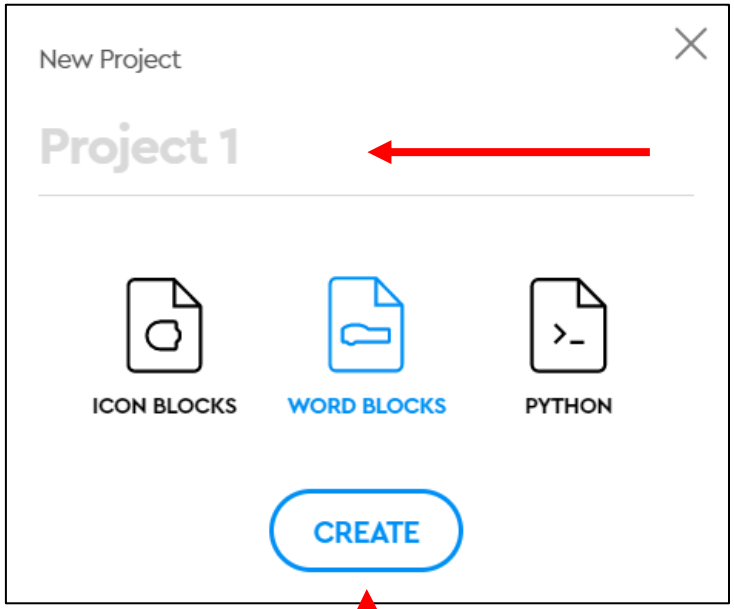
Is the LEGO Spike app open and on screen?
Is Spike connected and ready to use?

Do you know how to download programs to Spike and select programs from Spike?

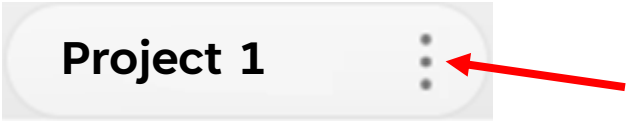
Movement


LEGO Education SPIKE - 2.0.6
File Help
Home
Start
Units
Build
My Projects
Help
Settings
SPIKE Prime
Get started with SPIKE™ Prime
Learn to use SPIKE Prime in 6 easy steps!
START
Recent projects
New Project
Click the New Project button.
Unit Plans
Building Instructions

Movement



OR

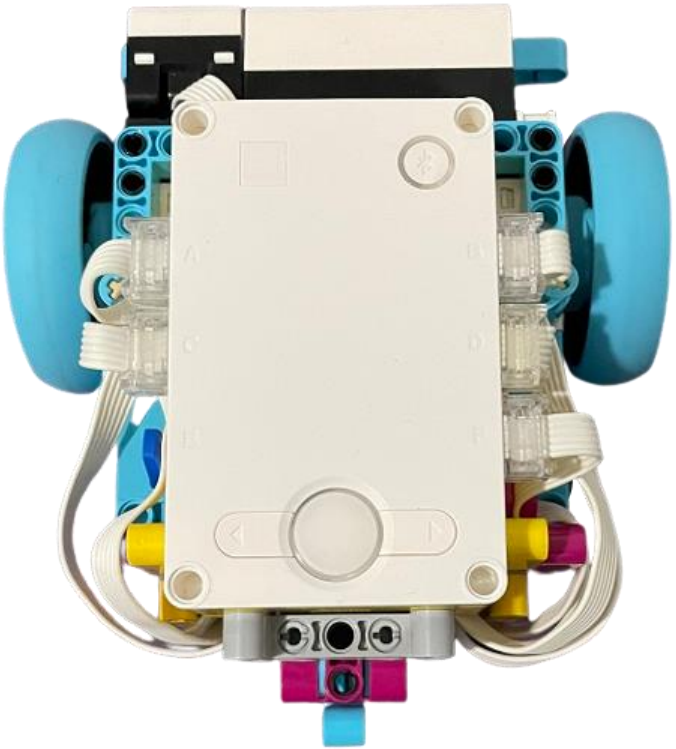


Name your program.

- Click the three dots OR click in the New Project window.
- Name your project: **Move-**_____ *(your names).*

Click WORD BLOCKS and then the CREATE button.

Movement



The Robocar motors that make it move are connected to ports A and B.

If for some reason the motors are not connected to ports A and B, please let Mr. Desmond know.

Do not connect the light. For now, it is purposefully disconnected from port C.

Movement

Robot Movement - Exploration 1

Activity Goals

1) To explore how to make a robot move for a certain number of seconds.
2) To investigate and compare the differences in how far a robot will travel as the travel time changes.
3) To explore the relationship between time, speed, and distance as they relate to robot movement.

Movement

Robot Movement - Exploration 1

Activity Steps

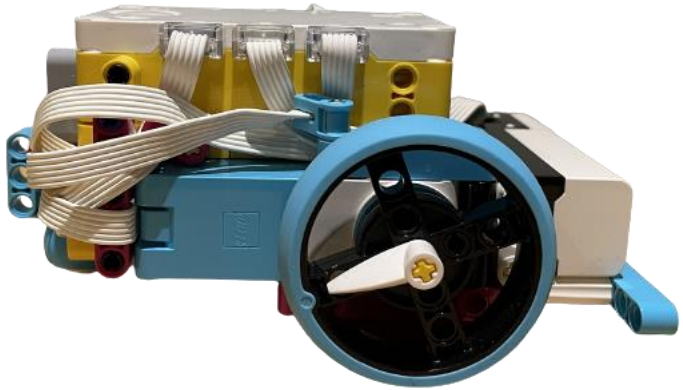
1) Create a chart to record Exploration 1 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Exploration 1 testing setup check-in. Setup Check-in
4) Read the Exploration 1 testing instructions. Instructions
5) Download your code and complete the testing. Test
6) Think about your Exploration 1 results. Think
7) Answer question and explain your ideas. Explain

Movement

Robot Movement - Exploration 1

On a piece of paper create a copy of this chart to record your findings for how far the Robocar travels.

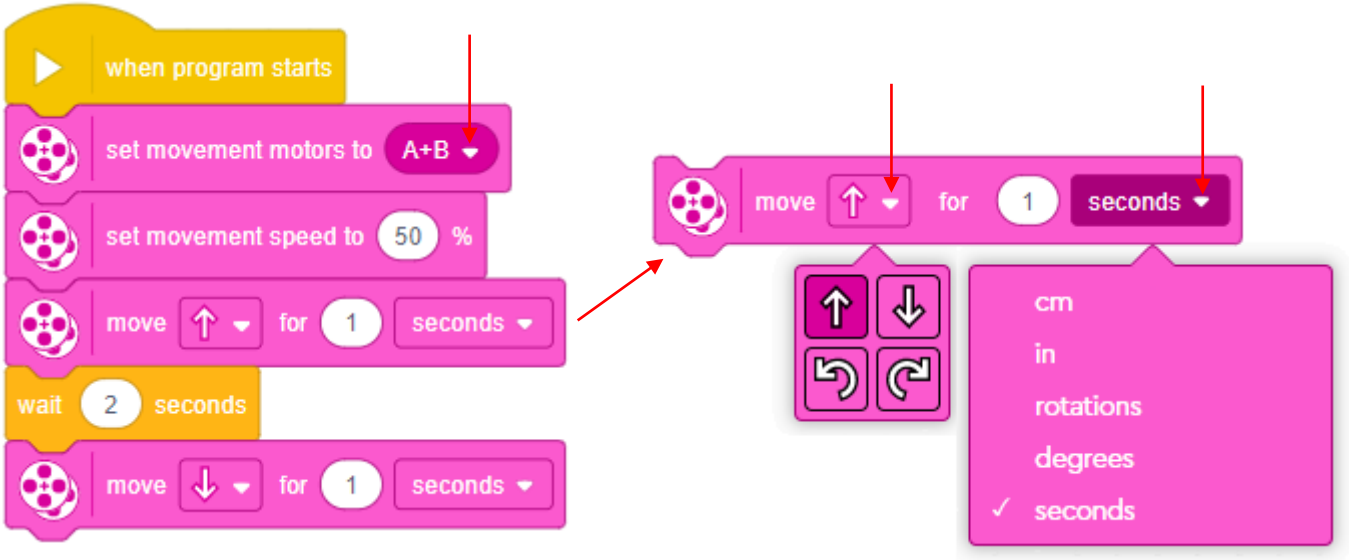
Movement Exploration 1		
Speed (%)	Time (s)	Distance (cm)
50 %	1 s	cm
50 %	2 s	cm
50 %	4 s	cm



Movement

Robot Movement - Exploration 1

Create a code sequence to have the Robocar move forward for one second and then backward for one second.

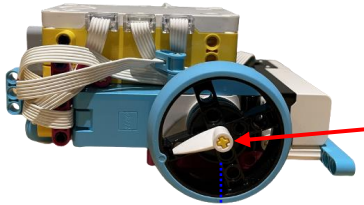


Do not download or run your code yet.

Movement

Robot Movement - Exploration 1

Get a 100 centimeter ruler. Position the ruler across the long side of the table so that the Robocar is ready to move without crashing or falling off the table.



For consistent measurements always use the location of the Robocar's wheel axle (the center-point of the wheel).

Position the Robocar's wheel axle even with zero on the ruler.

Check in with Mr. Desmond.

Movement

Robot Movement - Exploration 1

Read all of the following instructions.

1) Measure how far forward the Robocar travels at 50% speed for 1 second. Record your findings in your chart.

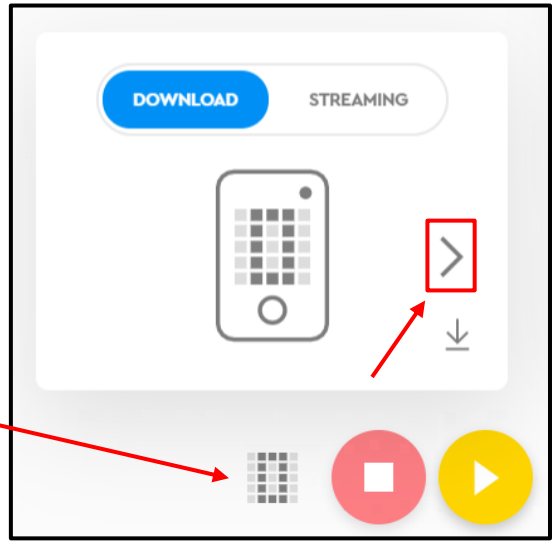
2) Change the time in your code to 2 seconds.
Measure how far forward the Robocar travels at 50% speed for 2 seconds. Record your findings in your chart.

3) Change the time in your code to 4 seconds.
Measure how far forward the Robocar travels at 50% speed for 4 seconds. Record your findings in your chart.

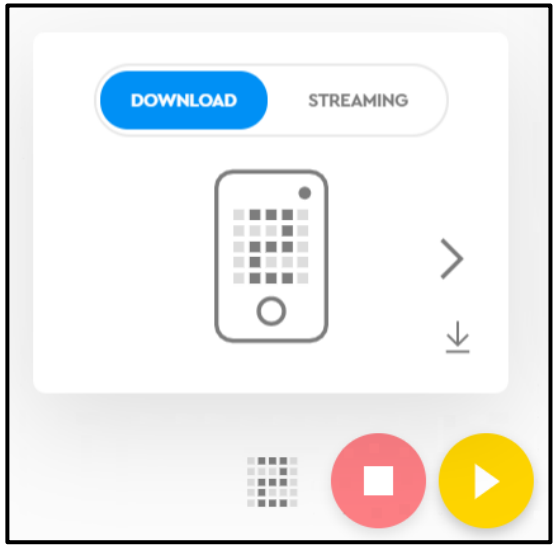
Movement

Robot Movement - Exploration 1

Click the program memory slot button.



Change the program memory slot to 2.



Download the program to Spike.

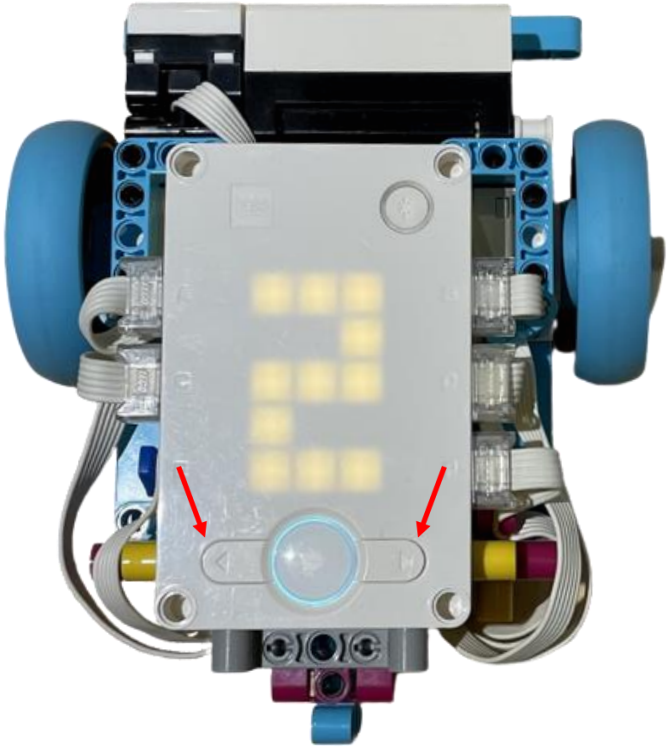
When complete go to the next page.

Movement

Robot Movement - Exploration 1

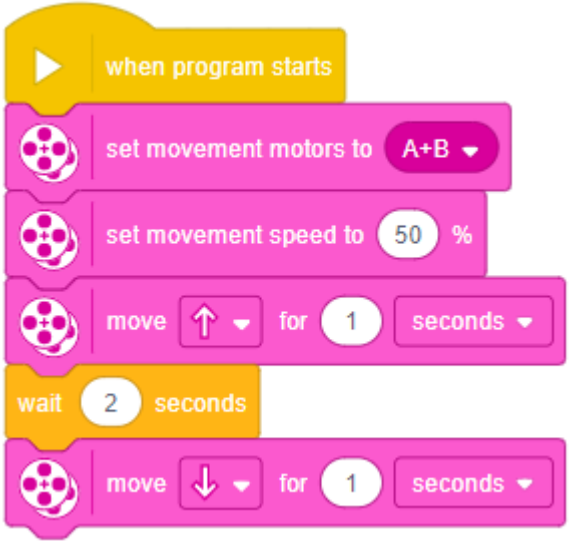
Use the left, right buttons on the top of Spike as required to locate your Move program from memory slot 2.

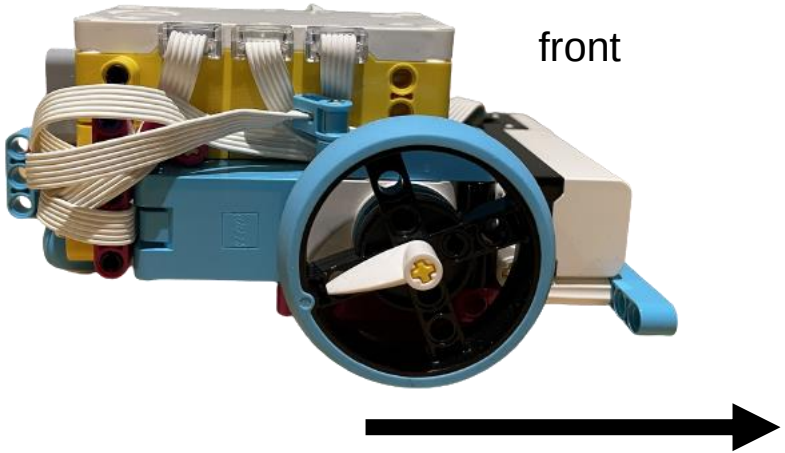
Notice how the display changes as you use the control buttons.



Movement

Robot Movement - Exploration 1





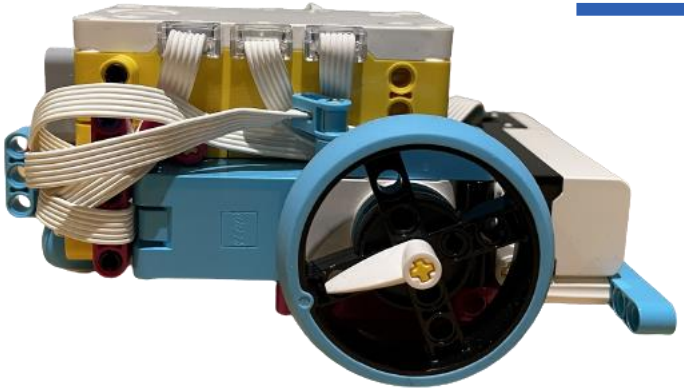
Run your program from Spike.

Begin the testing. Complete each test twice.

Movement

Robot Movement - Exploration 1

Think about the travel difference between 1 second, 2 seconds, and 4 seconds.



1s ? → 2s ? → 4s ?

Discuss any general patterns about how far the Robocar travelled that you noticed.
[Sometimes rounding numbers helps us to see general patterns.]

Check in with Mr. Desmond.
Be prepared to show your completed chart.

Movement

Robot Movement - Exploration 1

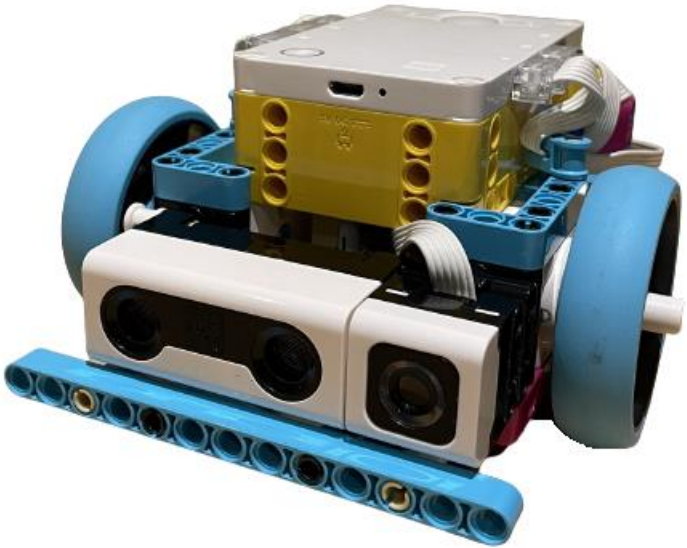
Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

1) Look at the results recorded in your chart.
   What did you notice about the distance the Robocar travelled as the time increased?
2) Based on your results how far do you think the Robocar will travel at 50% speed for 6 seconds?
3) Think about the time it takes to move a certain distance.
   Explain how time affects the distance an object will travel.

Movement

Robot Movement - Exploration 1

Check in with Mr. Desmond.
Be prepared to show your work and discuss your ideas.



Movement

Robot Movement - Exploration 2

Activity Goals

1) To explore how to make a robot move at a certain speed.
2) To investigate and compare the differences in how far a robot will travel as the speed changes.
3) To explore the relationship between time, speed, and distance as they relate to robot movement.

Movement

Robot Movement - Exploration 2

Activity Steps

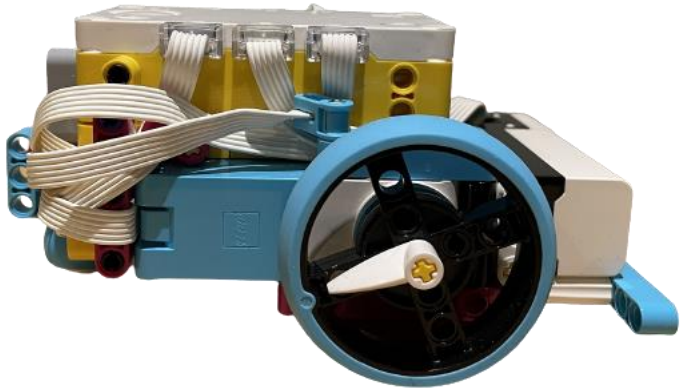
1) Create a chart to record Exploration 2 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Exploration 2 testing setup check-in. Setup Check-in
4) Read the Exploration 2 testing instructions. Instructions
5) Download your code and complete the testing. Test
6) Think about your Exploration 2 results. Think
7) Answer question and explain your ideas. Explain

Movement

Robot Movement - Exploration 2

Create a copy of this chart to record your findings for how far the Robocar travels.

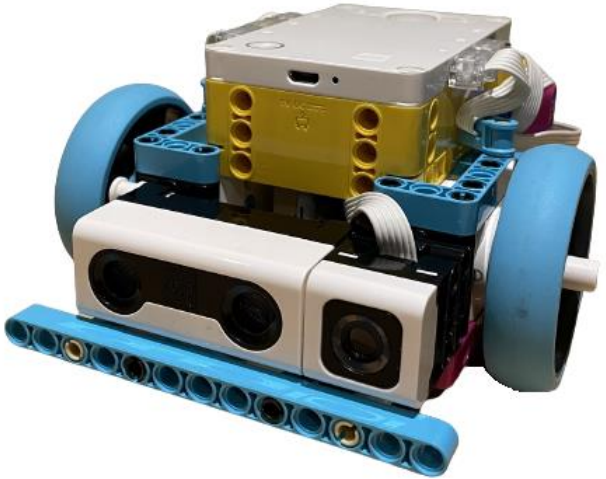
Movement Exploration 2		
Speed (%)	Time (s)	Distance (cm)
25 %	2 s	
50 %	2 s	
75 %	2 s	



Movement

Robot Movement - Exploration 2

Create a code sequence to have the Robocar move at 25% speed forward for two seconds and then backward for two seconds.

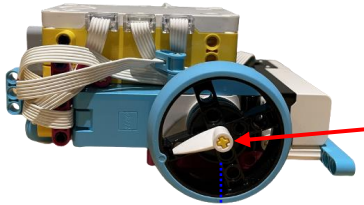


Do not download or run your code yet.

Movement

Robot Movement - Exploration 2

Get a 100 centimeter ruler. Position the ruler across the long side of the table so that the Robocar is ready to move without crashing or falling off the table.



For consistent measurements always use the location of the Robocar's wheel axle (the center-point of the wheel).

Position the Robocar's wheel axle even with zero on the ruler.

Check in with Mr. Desmond.

Movement

Robot Movement - Exploration 2

Read all of the following instructions.

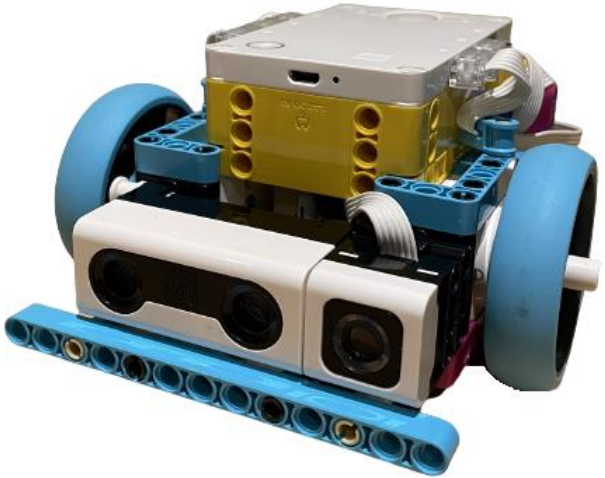
1) Measure how far forward the Robocar travels at 25% speed for 2 seconds. Record your findings in your chart.

2) Change the speed in your code to 50% speed.
Measure how far forward the Robocar travels at 50% speed for 2 seconds. Record your findings in your chart.

3) Change the speed in your code to 75% speed.
Measure how far forward the Robocar travels at 75% speed for 2 seconds. Record your findings in your chart.

Movement

Robot Movement - Exploration 2



Download the program to Spike.

Run your program from Spike.

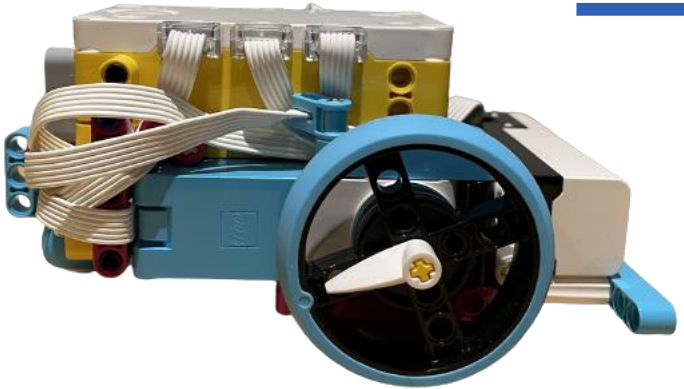
Begin the testing. Complete each test twice.

Movement

Robot Movement - Exploration 2

Think about the travel difference between 25% speed, 50% speed, and 75% speed.

25% ? → 50% ? → 75% ?



Discuss any general patterns about how far the Robocar travelled that you noticed.
[Sometimes rounding numbers helps us to see general patterns.]

Check in with Mr. Desmond.
Be prepared to show your completed chart.

Movement

Robot Movement - Exploration 2

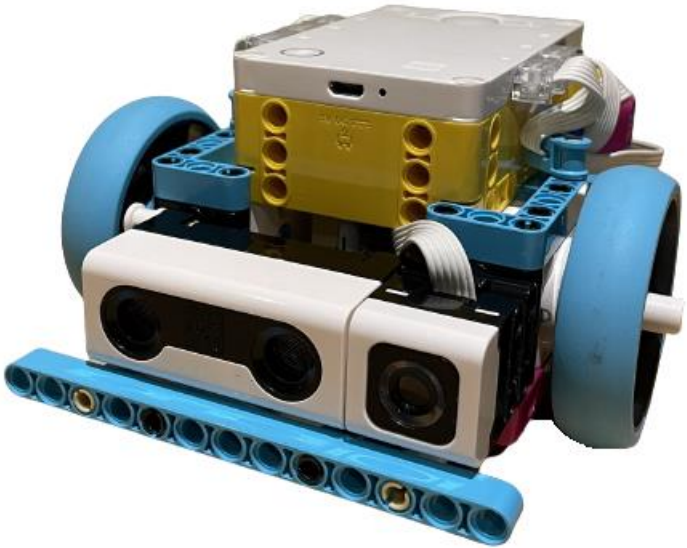
Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

1) Look at the results recorded in your chart.
   What do you notice about the distance the Robocar travelled as the speed increased?
2) Explain how the speed of a moving object affects how far it will travel.

Movement

Robot Movement - Exploration 2

Check in with Mr. Desmond.
Be prepared to show your work and discuss your ideas.



Movement

Robot Movement - Consider This

There tends to be common thinking about movement. Whether walking, bicycling, driving a car, travelling by train or air, people almost always think about how much time will it take to complete the journey.

An understanding of the relationships between time, speed, and distance is important when working with robotic systems that move. Robotic movement takes many forms: for example, a robot that moves around a series of obstacles, or a robot arm that moves to perform an action. How much robotic systems move (distance) is related to the time spent moving and the speed of movement.

Robot Movement - Exploration 3

Activity Goals

1) To explore how to make a robot move for a certain number of rotations.
2) To investigate and compare the differences in how far a robot will travel as the motor spindle rotations change.
3) To explore the relationship between time, speed, and distance as they relate to robot movement.

Movement

Robot Movement - Exploration 3

Activity Steps

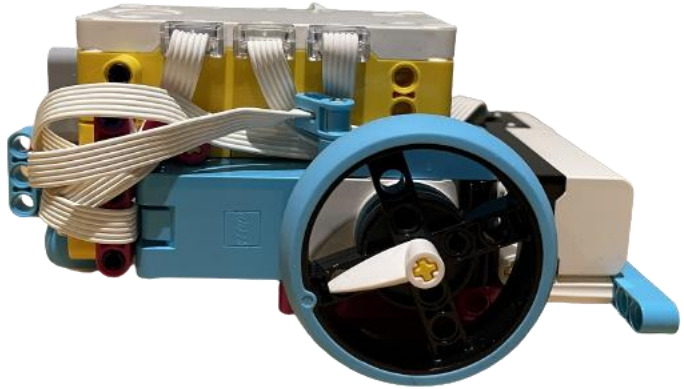
1) Create a chart to record Exploration 3 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Read the Exploration 3 testing instructions. Instructions
4) Download your code and complete the testing. Test
5) Additional exploration. Explore More
6) Answer question and explain your ideas. Explain

Movement

Robot Movement - Exploration 3

Create a copy of this chart to record your findings for how far the Robocar travels.

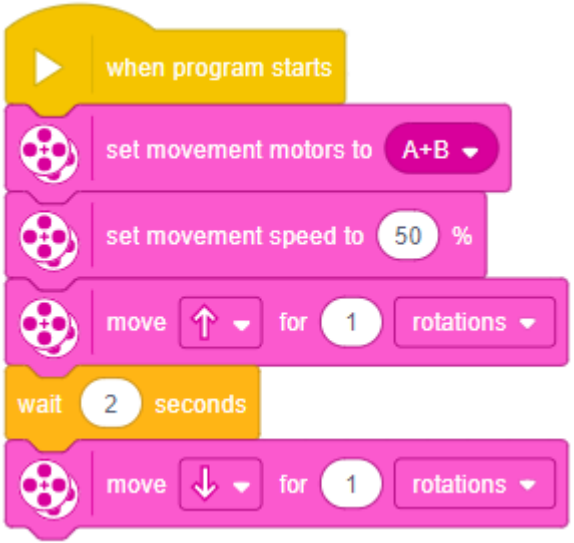
Movement Exploration 3		
Speed (%)	Duration	Distance (cm)
50 %	1 rotation	
50 %	2 rotations	
50 %	3 rotations	

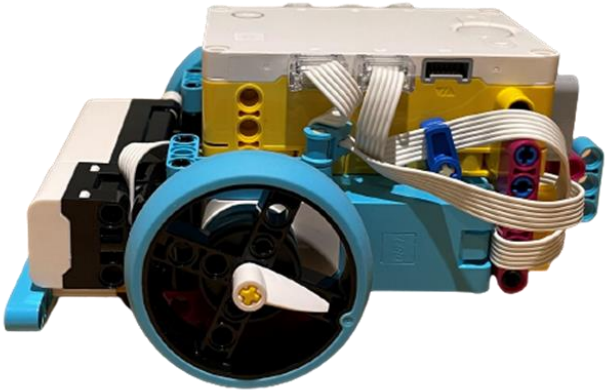


Movement

Robot Movement - Exploration 3

Create a code sequence to have the Robocar move forward for one rotation and then backward for one rotation.





Do not download or run your code yet.

Movement

Robot Movement - Exploration 3

Read all of the following instructions.

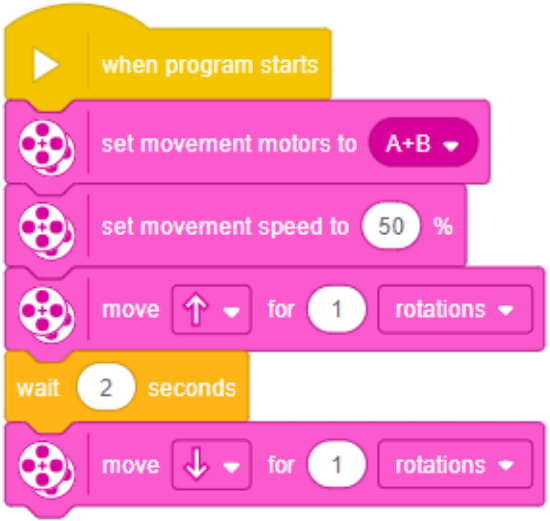
1) Measure how far the Robocar travels after 1 rotation.
Record your findings in your chart.

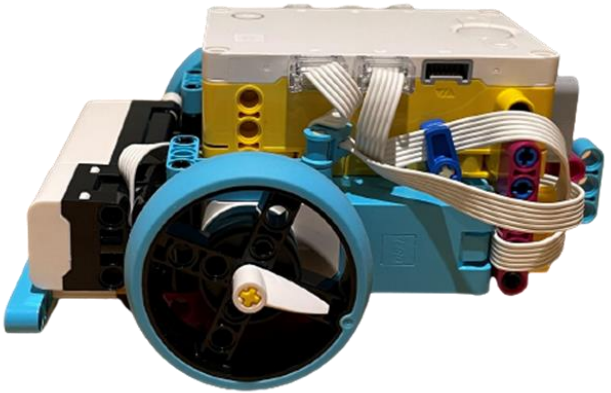
2) Change the duration in your code to 2 rotations.
Measure how far the Robocar travels after 2 rotations.
Record your findings in your chart.

3) Change the duration in your code to 3 rotations.
Measure how far the Robocar travels after 3 rotations.
Record your findings in your chart.

Movement

Robot Movement - Exploration 3





Download the program to Spike.

Run your program from Spike.

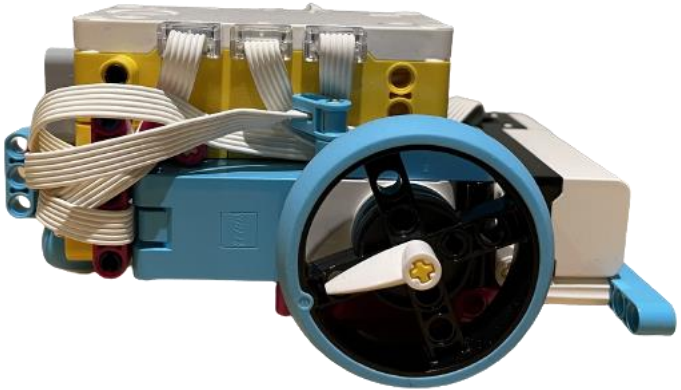
Begin the testing. Complete each test twice.

Movement

Robot Movement - Exploration 3

Are rotations consistent no matter the speed?
Try these explorations to test that idea.

How far does the Robocar travel at 25% speed after 2 rotations.
How far does the Robocar travel at 50% speed after 2 rotations.
How far does the Robocar travel at 75% speed after 2 rotations.



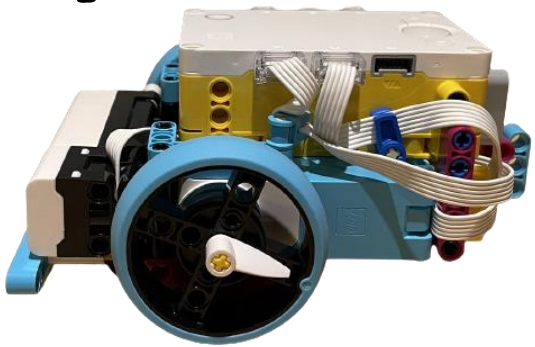
Check in with Mr. Desmond.
Be prepared to show your coding and demonstrate how it works.

Movement

Robot Movement - Exploration 3

Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

1) What part of the Robocar is moving when using rotations as the duration unit?
   What does one rotation mean?
2) What is your prediction for how far the Robocar would travel after 4 rotations?
3) How are rotations as a duration different than using seconds as the duration?

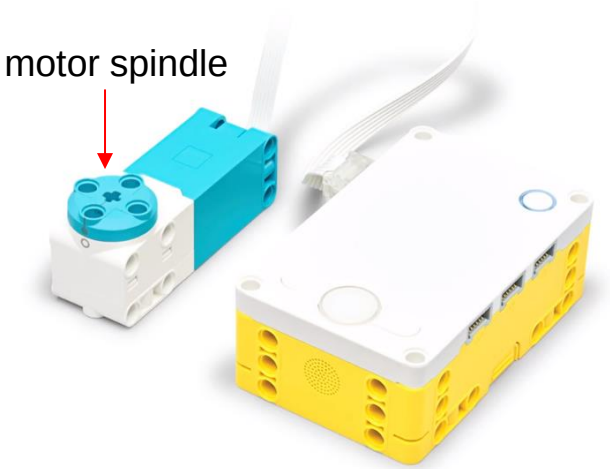


Check in with Mr. Desmond.
Be prepared to show your answers.

Movement

Robot Movement - Consider This

When the motor runs it is the motor spindle that is moving (spinning). The Robocar's wheels are attached to the motor spindle. That means the wheels spin at the same time and at the same rate as the spindle.



When the motor runs the spindle moves for a certain duration as controlled by the coding. For example, if we were to code the Robocar's motors to move for 3 rotations each motor spindle would spin in a full circle three times.

Movement

Robot Movement - Exploration 4

Activity Goals

1) To explore how to make a robot move for a certain number of degrees.
2) To investigate and compare the differences in how far a robot will travel as the degrees of motor spindle turns change.
3) To explore the relationship between time, speed, and distance as they relate to robot movement.

Movement

Robot Movement - Exploration 4

Activity Steps

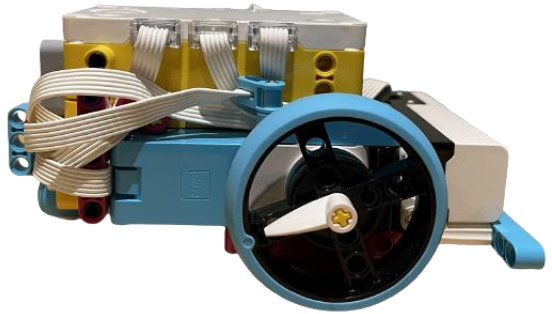
1) Create a chart to record Exploration 4 data. Chart
2) Create a code sequence to move the Robocar. Code
3) Read the Exploration 4 testing instructions. Instructions
4) Download your code and complete the testing. Test
5) Answer question and explain your ideas. Explain

Movement

Robot Movement - Exploration 4

Create a copy of this chart to record your findings for how far the Robocar travels.

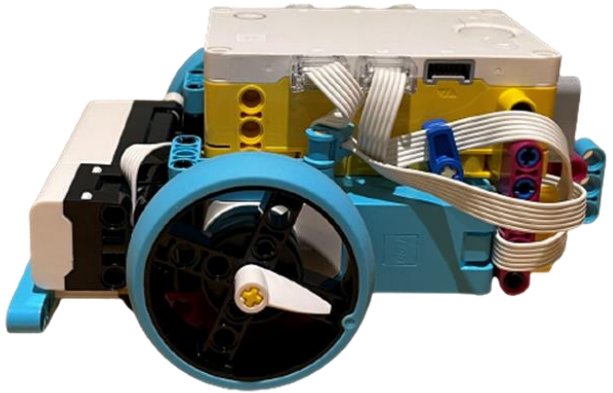
Movement Exploration 4		
Speed (%)	Duration	Distance (cm)
50 %	360 degrees	
50 %	180 degrees	
50 %	90 degrees	



Movement

Robot Movement - Exploration 4

Create a code sequence to have the Robocar move forward for 360 degrees and then backward for 360 degrees.



Do not download or run your code yet.

Movement

Robot Movement - Exploration 4

Read all of the following instructions.

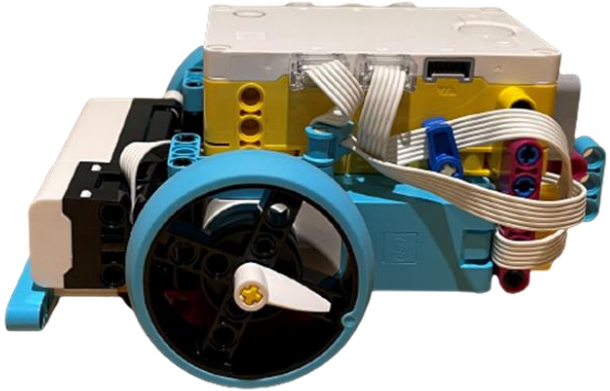
1) Measure how far the Robocar travels with a duration value of 360 degrees. Record your findings in your chart.

2) Change the duration in your code to 180 degrees. Measure how far the Robocar travels with a duration value of 180 degrees. Record your findings in your chart.

3) Change the duration in your code to 90 degrees. Measure how far the Robocar travels with a duration value of 90 degrees. Record your findings in your chart.

Movement

Robot Movement - Exploration 4



Download the program to Spike.

Run your program from Spike.

Begin the testing. Complete each test twice.

Movement

Robot Movement - Exploration 4

Think about it, discuss your ideas as a group, and then write your answers on your paper below your chart.

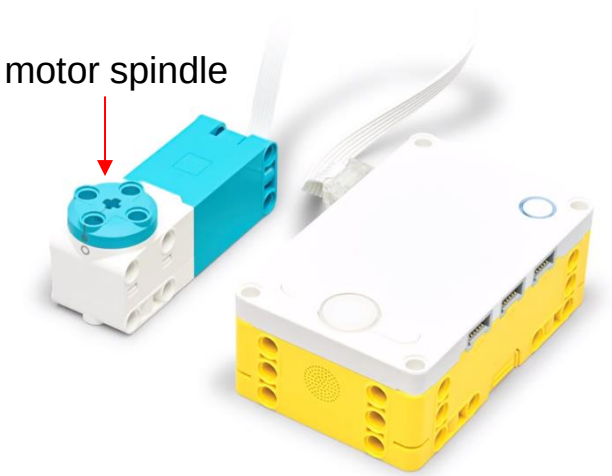
1) How are degrees as a duration unit different from using seconds as the duration unit?
2) How many rotations? 90 degrees = __ rotation?
   180 degrees = __ rotation? 360 degrees = __ rotation?
3) What is the relationship between rotations and degrees?
4) Does degrees as a duration unit make the Robocar turn?

Check in with Mr. Desmond.
Be prepared to show your answers.

Movement

Robot Movement - Consider This

When the motor runs it is the motor spindle that is moving (spinning). The Robocar's wheels are attached to the motor spindle. That means the wheels spin at the same time and at the same rate as the spindle.

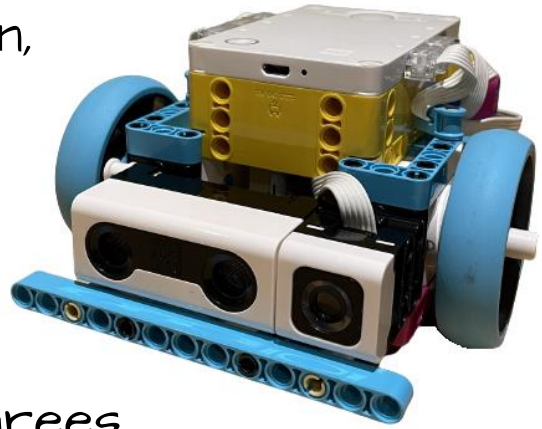


When the motor runs the spindle moves for a certain duration as controlled by the coding. The duration unit, whether it be seconds, rotations, or degrees, will determine how much the motor spindle moves (spins).

Movement

Robot Movement - Consider This

The duration unit is directly related to how much the Robocar's motor spindles spin, not how much the Robocar turns.
For example, if we were to code the Robocar's motors to move for 90 degrees each motor spindle would spin a quarter of a circle.
The Robocar would **not** turn by 90 degrees (a turn to the left or a turn to the right).

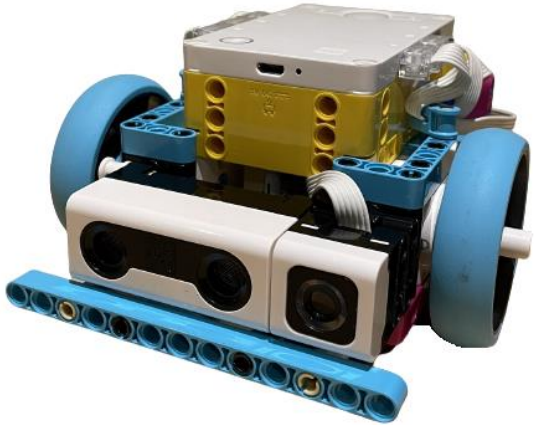


Movement

Robot Movement - Consider This

Time is a very useful duration unit when determining the distance (movement) of robotic systems that move about like the Robocar.

Degrees and rotations can be very useful when working with fine, precise, or exact movements such as the movement of a robotic arm.



Movement Challenges

Learning Goals

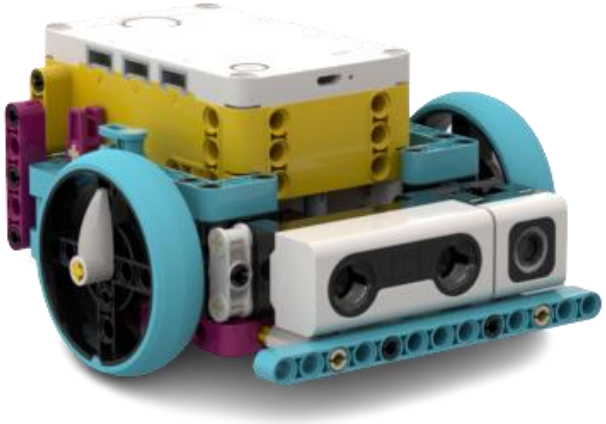
- Build knowledge about coding and robotics by coding a robot to make it move.
- Independently create code to make a robot move forward and backward.
- Have FUN learning!

Movement Challenges

Challenge 1 - There and Back

Program the Robocar using seconds as the duration unit to move forward 30 cm and then return to the starting point by travelling backward.

Add a single sound effect to the end of your program.



You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code before you begin the next activity.

Movement Challenges

Challenge 2 - Mixed-Up Forward Challenge

Program the Robocar using seconds as the duration unit to move forward 40 cm, play a beep sound effect, move backwards 15 cm, play a beep sound effect, and then move forward 25 cm.

You are expected to demonstrate your success to Mr. Desmond - showing both the robot in action and the code.