

Chapter 19: Student Worksheets

In this section you will find all the student worksheets referred to in the preceding chapters. The owner of this book has photocopy permission to reproduce as many copies of these worksheets as is required by their class. Worksheets can also be downloaded in PDF format from the following website:

www.damienkee.com

SPYKEE Basics

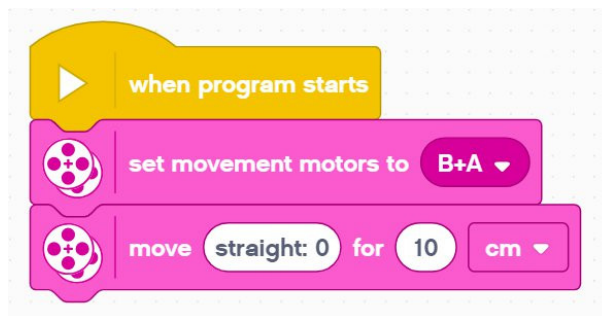
Group Name _____

Group Members _____

Project: THE SPACE AGENCY is in the market for a new planetary rover to explore the recently discover planet Tobor-3. You are required to construct and test a robot that is capable of following a set of commands to explore the planet's surface. Before the robot is deployed, it must be extensively tested to ensure it will perform as expected. You can't fly a technician to Tobor-3 to reboot the robot!

Before we send our robot into space, we must first test it thoroughly here on earth. Run the following experiments and observe how your robot behaves. Do not move to the next experiment until your teacher has seen your current experiment.

Drive Forward for 50cm. Download and test the following code



Drive Forward for 2 rotations of the wheels

How far did your robot travel?

Drive Forward for 2 degrees of the wheels

How far did your robot travel?

Drive Forward for 2 seconds of the wheels

How far did your robot travel?

What is the circumference of the robots wheel?

(hint: you will need to measure the diameter of the wheel)

How far will the robot drive if the wheels turn 3 rotations?

Program your robot to move 3 rotations and measure how far it goes.

Does it go as far as you expected?

Drive Forward 5 rotations slowly and then 1800 degrees backwards as fast as possible.

Make your robot turn around a complete circle (360 degrees).

What happened? How far did your robot turn if you type in 360°?

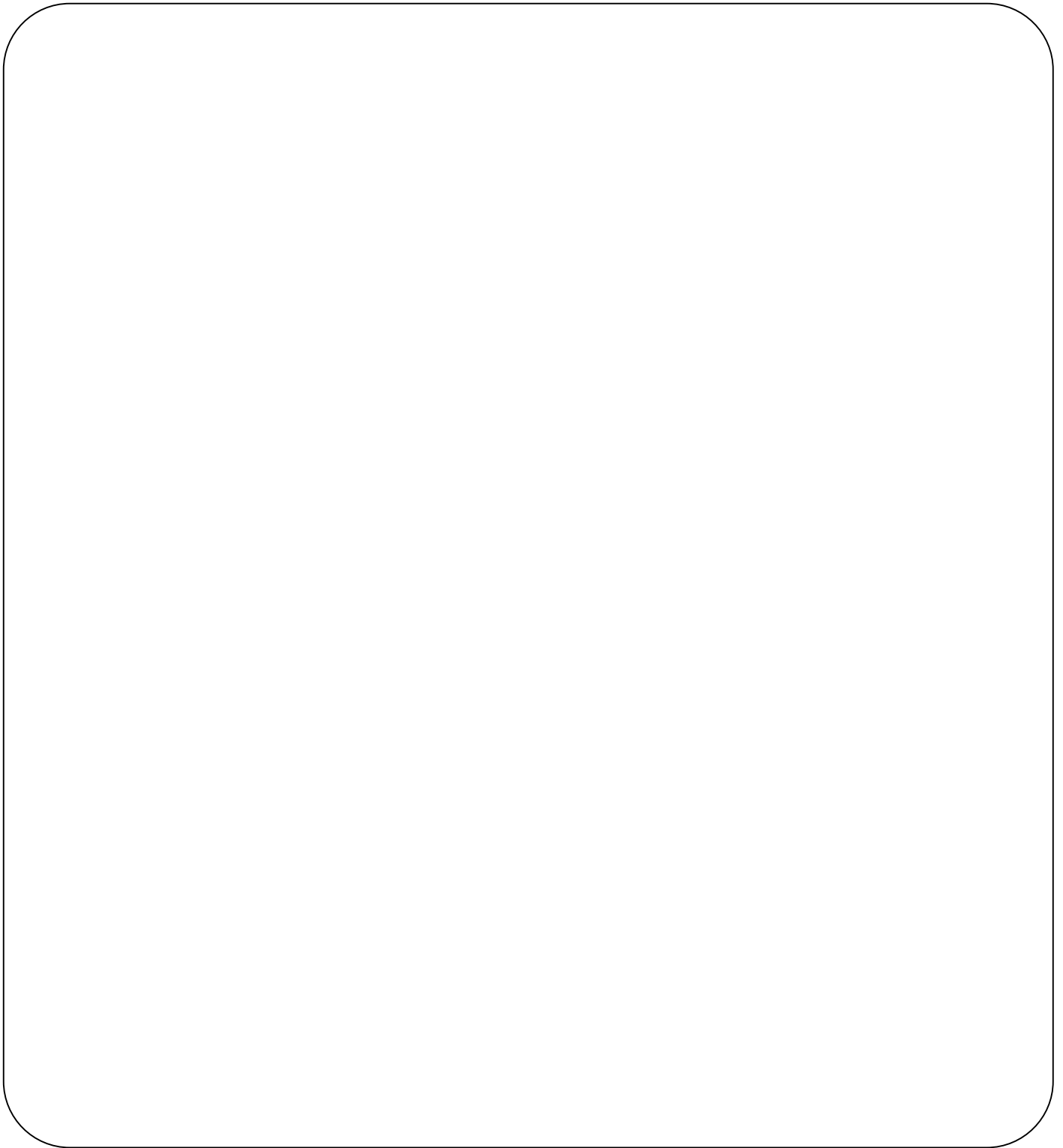
How many Degrees of the Wheel does your robot need to turn a complete circle?

(hint: keep experimenting until it is perfect!)

Drive forward for 500mm (OR 20 inches), turn around 180° and drive back to where you started

Make your robot drive in a 'figure of 8'

(hint: draw a diagram first in the space below before you start programming. Don't forget to mark your starting point!)



What is a Robot?

When you hear the word 'robot' some famous movie robots spring to mind. Robots in real life however are not yet up to the standard of their movie counterparts.

Robots are becoming more prevalent in today's society. They are used in high level applications such as space exploration right through to commercial vacuuming robots found in everyday households. You are required to do a research assignment on robotics in general and to focus on one robot in particular.

Robots come in many different shapes and sizes and are often tailored to meet a particular need or action.

Assessment

Create a report on robotics. Your teacher will tell you the format of the report. The following questions will need to be addressed in your work.

- What is a robot?
- Why do we have robots?
- Name some different types of robots?
- What are the main components of a robot?
- Where did the term 'Robot' come from?

Pick one robot and elaborate on it. You must have your robot choice approved by your teacher before you start your research. You will need to include the following information in your report:

Sensors - What information does it take in? (e.g. Sound, distance etc)

Software - What does it do? (e.g. Vacuum floors, explore space)

Mechanical - What materials is it made out of? How does it move? (e.g. motors, arms and metal frames)

Robot Chosen _____

Due Date _____

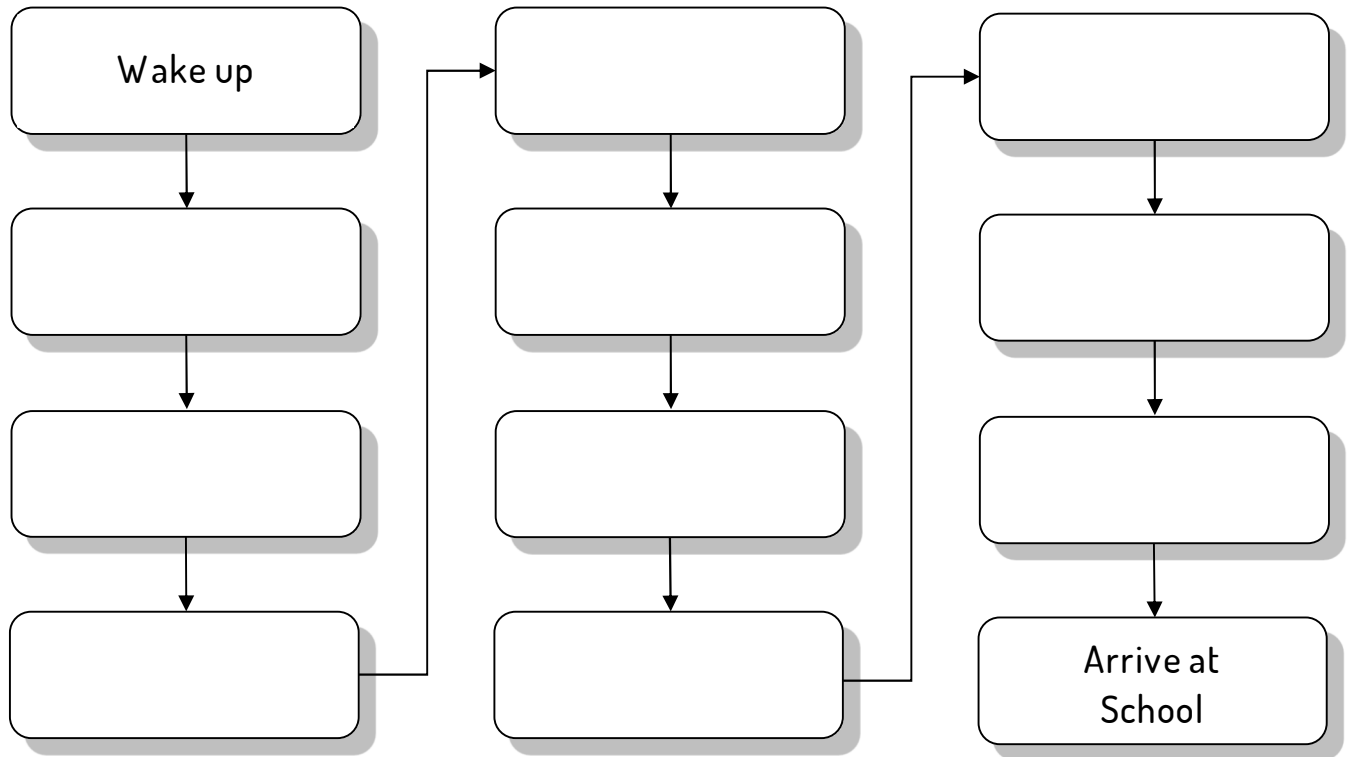
Presentation Type _____

Page / Slide limit _____

Flowcharting

All robots need to have programs to make them run. The easiest way to start a program is to first have a plan. This plan consists of a flowchart of small steps that make up the entire program. Each step is simple enough that the robot can perform it without too much effort.

Task: Using the blank flowchart below, plan out your daily morning routine, from when you wake up until you get to school.



How far?

Group Name _____

Group Members _____

Project: In the initial construction of the robot the travelling characteristics are required. After characterising the properties, THE SPACE AGENCY have asked that you use your data to make predictions about the distance your robot will travel given specific time constraints.

Your group will be assigned a random power level to be assessed. Power Level Assigned _____

For this experiment you will need to measure how far the robot travels for different time values (eg. 1 second, 2 seconds, 3.5 seconds etc). The more data you gather, the more accurate your graph will be.

Plot the results either on the graph below or in a graphing software package.

(Hint: you will need to know the smallest and largest times you tested for, as well as the smallest and largest distances so that you can determine the horizontal and vertical axis scales)

Once you have plotted your data, can you see a relationship between the time taken and the distance travelled?

By looking at the graph, can you determine how many seconds your robot would need to travel exactly 30cm (12 inches)? _____ seconds

How about 1.5m (59 inches)? _____ seconds

Your teacher will assign you a test distance. How long does your robot need to travel this particular distance?

Test Distance = _____

Time required = _____ seconds

Actual Distance = _____

(Measure from Graph)

(Measure actual robot travel distance)

How Many Sides?

Group Name _____

Group Members _____

Project: Once on Tobor-3, your robot will be required to identify interesting aspects for later analysis. Your robot will be required to mark off an area such that a passing satellite can easily identify the item in question. Initially you will be required to draw a square, but will then move onto other shapes and designs.

Build a drawing attachment and fix it to your robot and program your robot drive in a square.

- How many sides does a square have?
- How many angles?
- How many degrees in each angle?
- Could you use the loop block to make the program simpler?

Fill in the following table for other common shape

Shape	Number of sides	Internal angle	External angle	Turn Angle required by the robot
Octagon				
Hexagon				
Triangle				

What was the most difficult part of this challenge?

How did you go about solving it?

Help! I'm Stuck

Group Name_____

Group Members_____

Project: Whilst on Tobor-3, your robot will undoubtedly come up against obstacles in its path. THE SPACE AGENCY is worried about a particular cliff wall that is blocking the robots progress. They have asked that you demonstrate your robot's ability to detect such obstacles and navigate away from them. It is important that your robot does not physically touch these obstacles as we do not wish to damage the robot. Connect the Distance Sensor attachment to the front of the robot and ensure the cable is connected.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to a teacher before moving on.

We would like our robot to drive forward until it encounters an obstacle.

- Drive until object is detected, then stop.
- Turn around when you detect the object.
- Repeat this action until you find your way around the obstacle.

What was the most difficult part of this challenge?

How did you go about solving it?

Let's go Prospecting

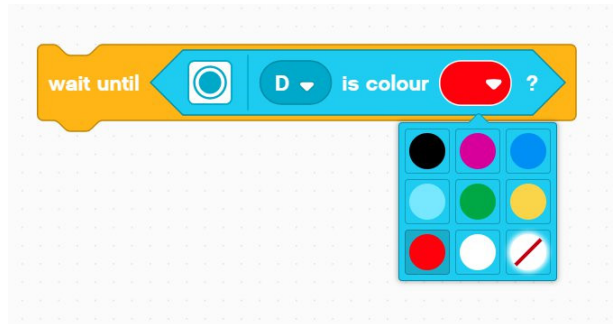
Group Name _____

Group Members _____

Project: THE SPACE AGENCY are very impressed with your robot's ability to navigate the surface. They are hoping that you can use a sensor on your robot to help them detect some mineral deposits of Spiketrium they believe are on the surface. These minerals are easy to spot due to their bright yellow appearance. Your task is to navigate a geological section, locate the mineral, stop and announce that a mineral has been found.

Build the Sensor Stack attachment for your robot.

The Spiketrium is known to be yellow in colour, so your robot will need to utilise the 'Wait for Colour' block to help detect it.



There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to your teacher before moving on.

- Drive until yellow is detected then stop.
- Shout 'Green' when you reach the Spiketrium.
- Drive off the green and go looking for more Spiketrium.

What was the most difficult part of this challenge?

How did you go about solving it?

Stay away from the Edge

Group Name_____

Group Members_____

Project: Another challenge the robot faces is staying safe whilst navigating on top of a large plateau. Get too close and over you'll go! THE SPACE AGENCY has asked that you prove your robot is capable of staying away from the edge of a cliff.

THE SPACE AGENCY has discovered that the Colour Sensor attachment, as well as being excellent for detecting Spiketrium, can also reliably give a reading of 'No-Colour' when it reaches the edge of the plateau. Modify your program so that the robot does not go over the edge.

There are several progressive steps we would like to make in order to solve this problem. Each program should be done individually and demonstrated to your teacher before moving on.

- Drive until the edge is detected then stop.
- Drive away from the edge and continue looking for the next edge.

What was the most difficult part of this challenge?

How did you go about solving it?

Prospecting and Staying Safe

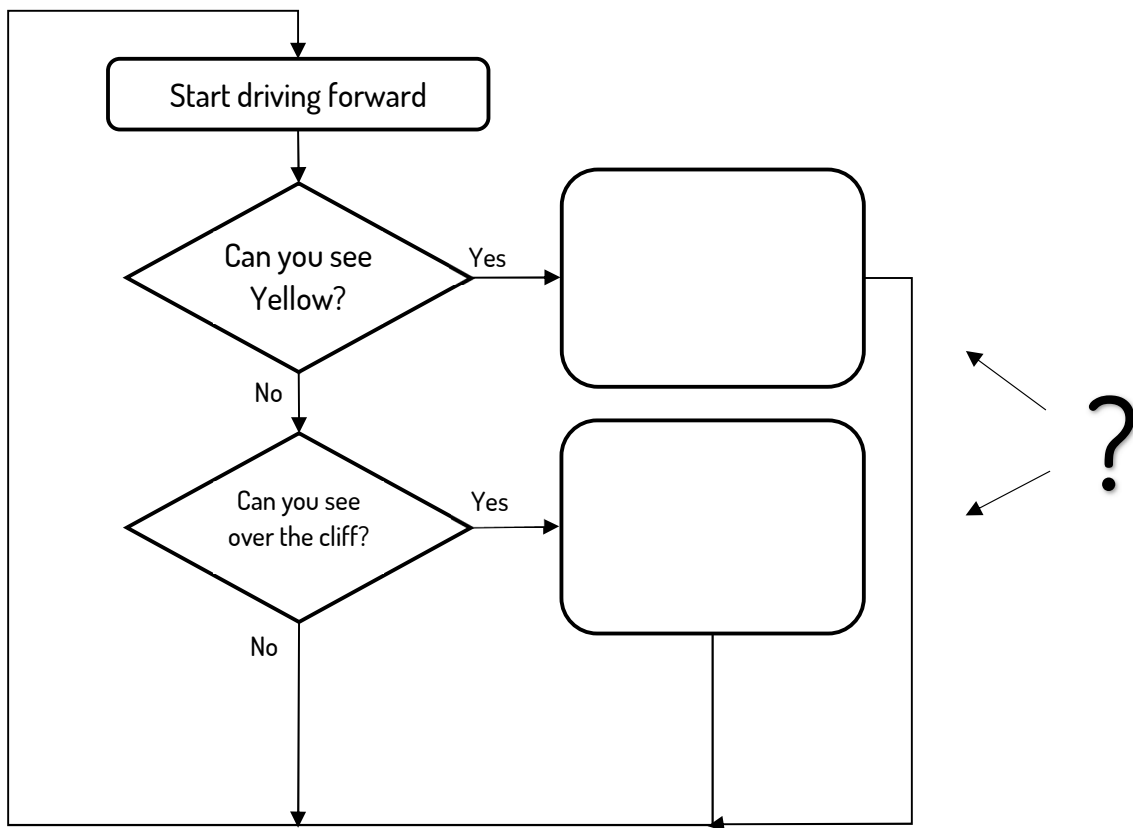
Group Name _____

Group Members _____

Project: THE SPACE AGENCY are very impressed, but they note with your last program, while the robot is looking for the edge of the plateau, it is not doing any prospecting. Is there a way to do both at the same time?

As there is only one 'Wait' Block that can be used to determine colour, you will need to find a way for the robot to be able to determine which colour it has seen. This can be achieved with a 'IF' Block.

Use this flow chart as a starting point, and fill in the blank spaces



Prepare the Landing Zone

Group Name_____

Group Members_____

Project: THE SPACE AGENCY has identified a good landing site for further spacecraft but unfortunately it still contains several large obstacles.

Use your robot and an appropriate attachment to clear the area.

The robot will be required to turn to find an obstacle. Once located, have your robot drive up to the obstacle, take control of it with an attachment and move the obstacle to a new location.



**Dangerous obstacle!
Must be moved!**

This challenge is best approached as a series of programs. Ensure you have shown your teacher each intermediate program as you work towards the final solution.

- Turn until you see the obstacle and then stop.
- Turn to the obstacle and then drive up to the obstacle.
- Go to the obstacle and close the gripper sufficiently.
- Go to the obstacle, collect the obstacle and move it to a different location.

Extension Activity

Multiple obstacles are present, and all need to be removed. The safest place for them to be deposited is the Dangerous Removal of Obstacle Position (DROP). It is located to the side of the Landing Zone and can be identified by the bright red floor covering (Hint: You'll need to build in the Colour Sensor somewhere!)

As seen on TV!

Project: THE SPACE AGENCY has decided to use your design to fly to Tobor-3. As a result of the associated publicity, many other people want to buy their own version of the robot. Come up with a marketing promotion to sell your robot.

Your presentation may consist of one or more of the following media formats as notated by your teacher

- School Newspaper article
- Video commercial
- PowerPoint Presentation
- Poster presentation
- Website
- Oral Presentation

Be sure to include the following information in your presentation

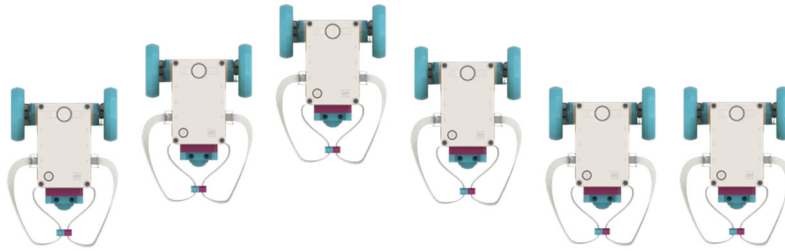
- How does it look?
- What can it do?
- How does it move?
- How does it sense its surrounding environment?
- What are the standard missions it can perform?

Look back over your previous activities to help you answer these questions.

Remember, you are now pitching your idea to everyday people, not THE SPACE AGENCY scientists!

Additional Projects

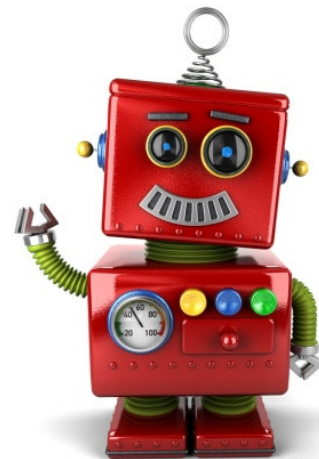
Robot Wave: Synchronise a group of robots to perform the Wave, an audience move popular in sporting stadiums around the world. As a class, you will need to determine what order the robots will move and what action they will perform.



Robot Butler: Robots in the household are quickly becoming commonplace, with personal assistance robots widely regarded to become the most prevalent in the near future. Build a robot that can retrieve a drink for someone who is confined to bed.

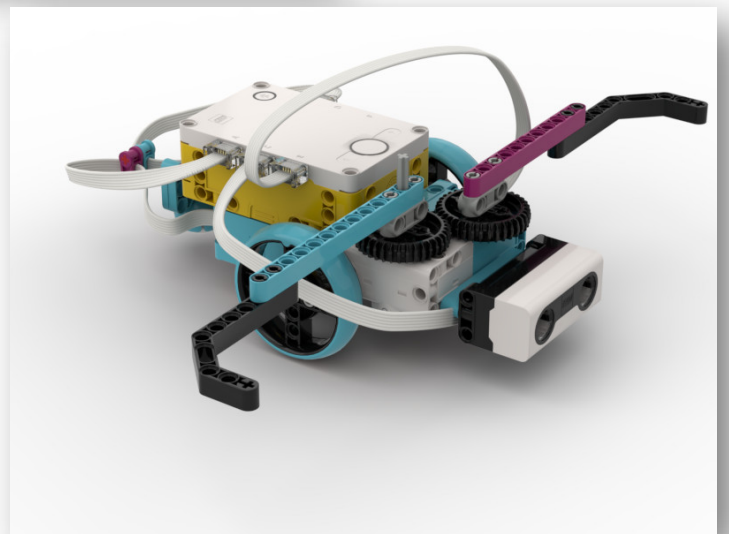
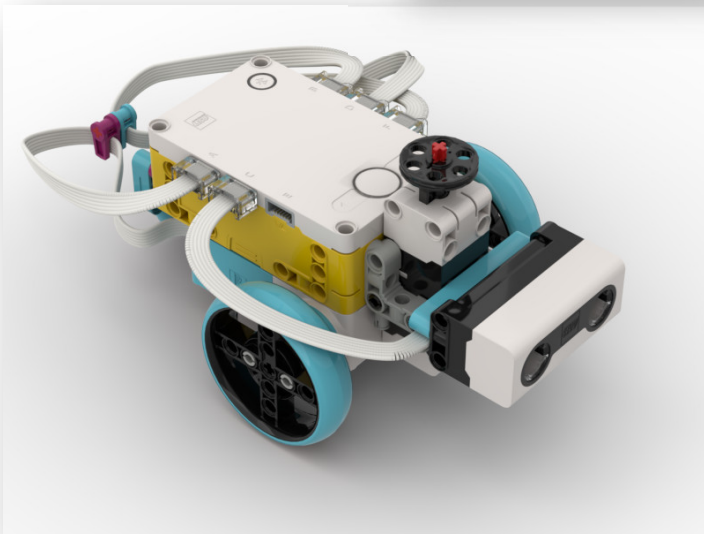
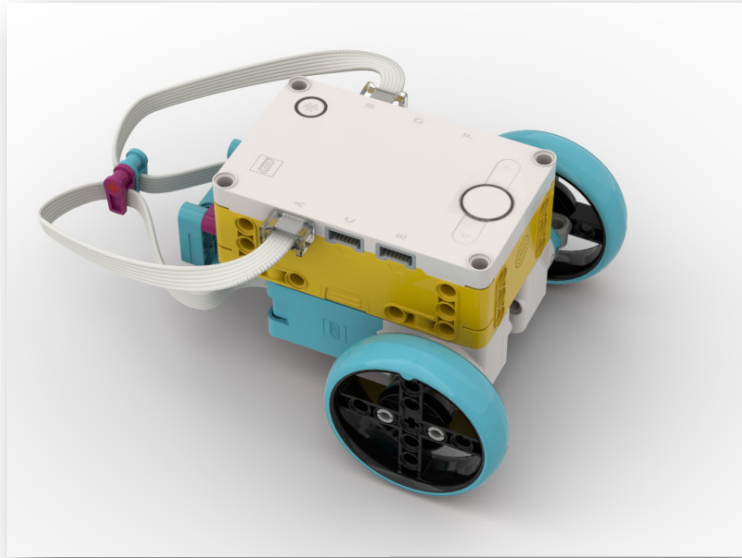


Meet your Adoring Public: Program your robot to respond in a positive way when somebody gets close. Use the **Move**, **Sound** and **Light** blocks to convey a feeling of happiness.

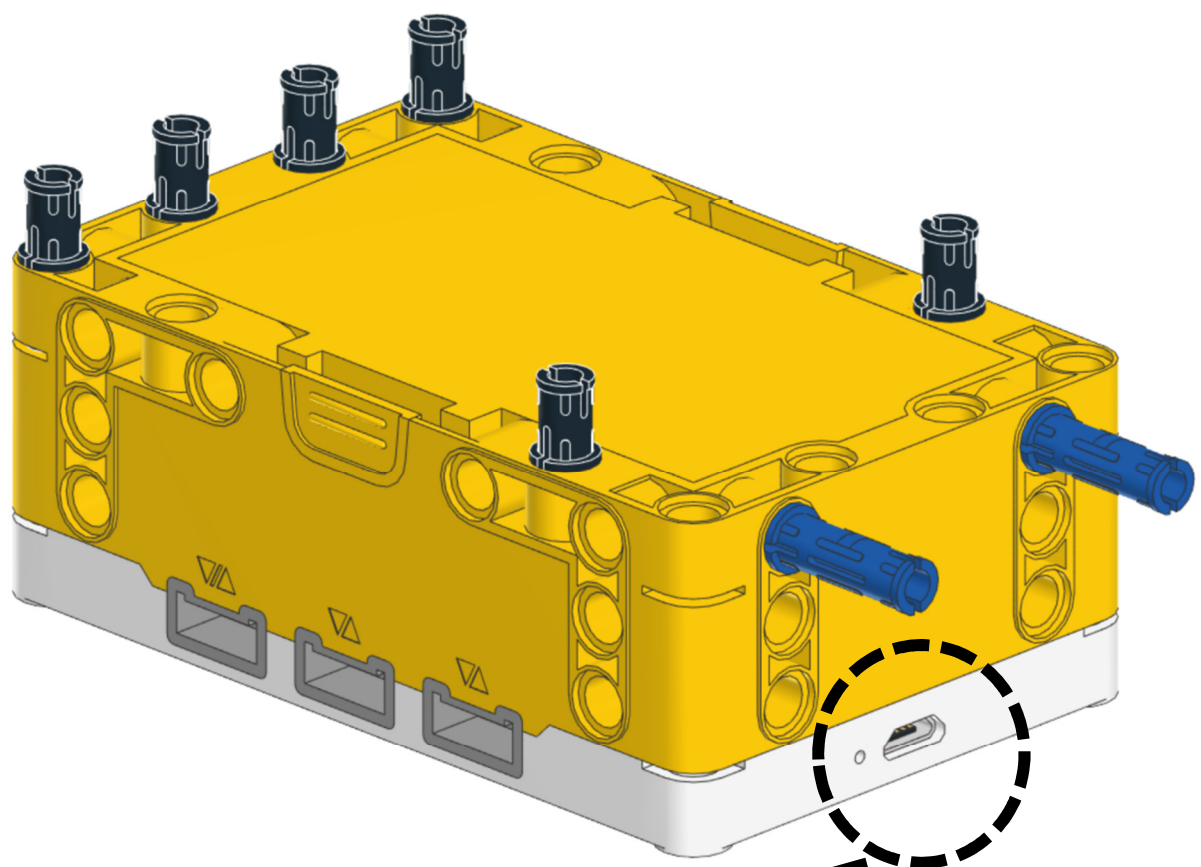
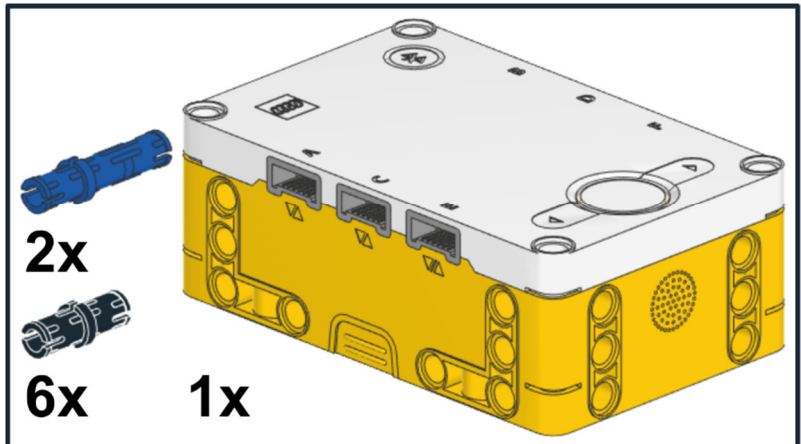


SPY KEE

Building Instructions



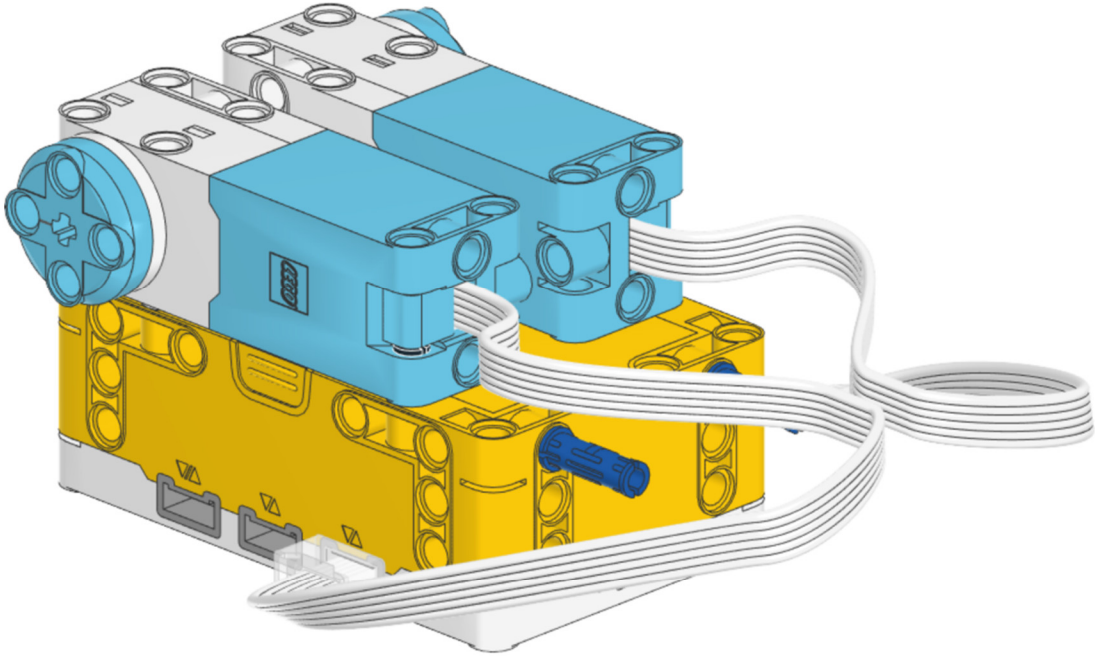
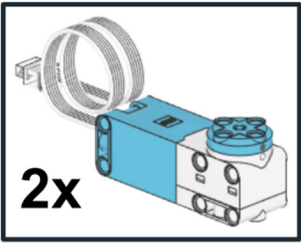
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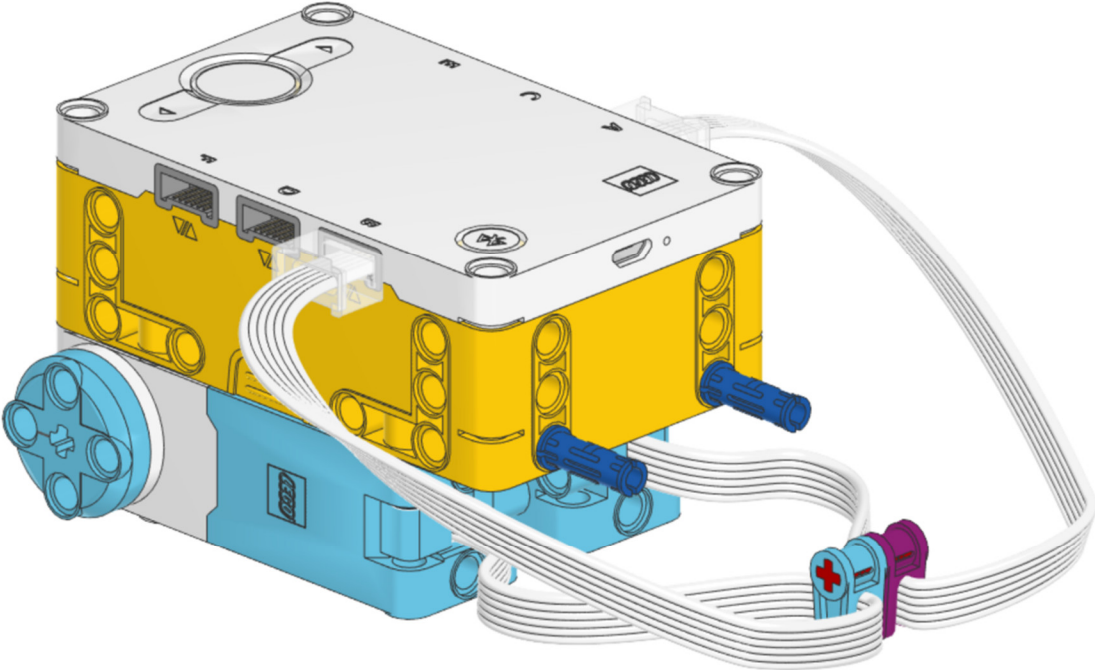
Charging Port on this side

Plug into A and B

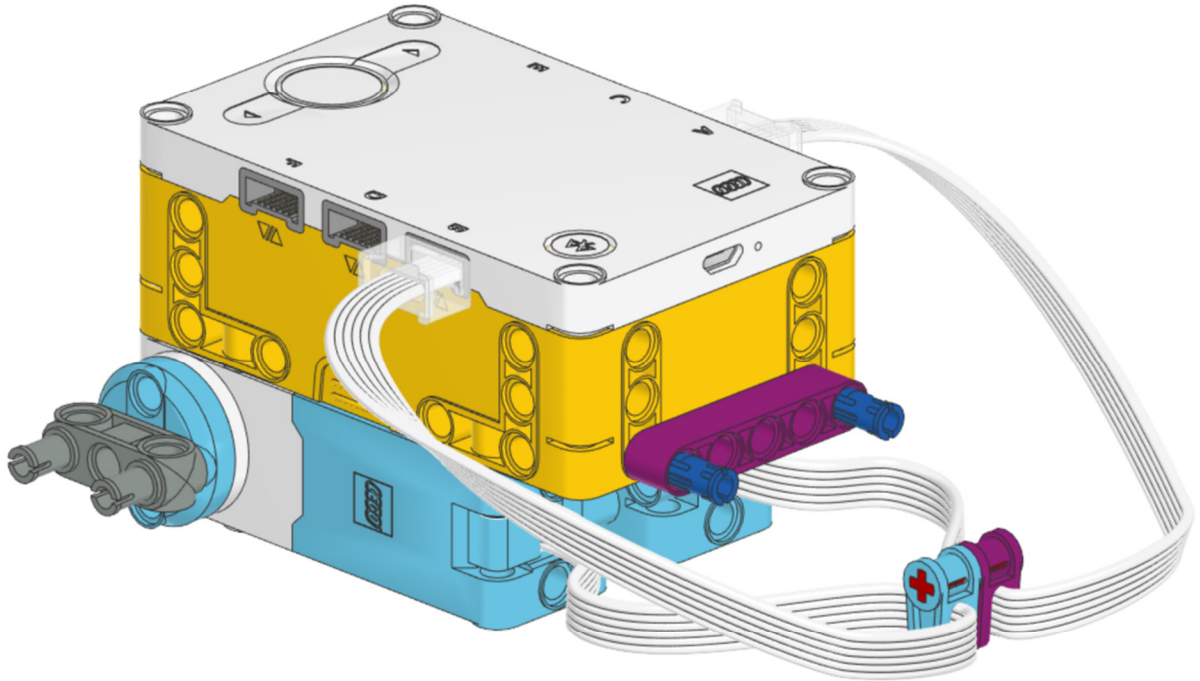
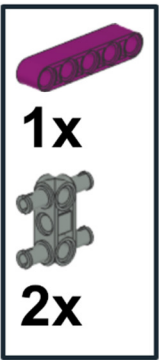
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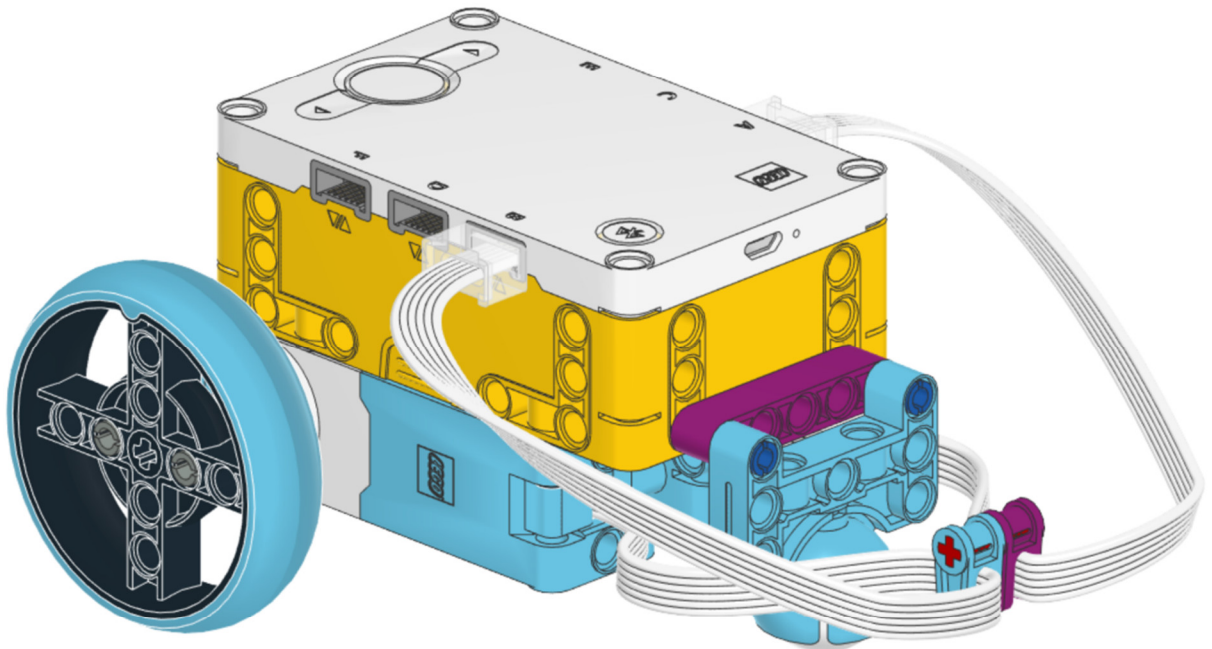
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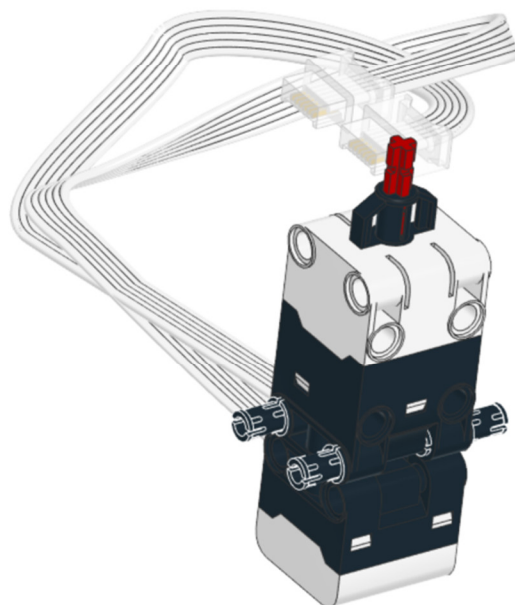
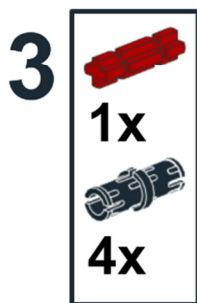
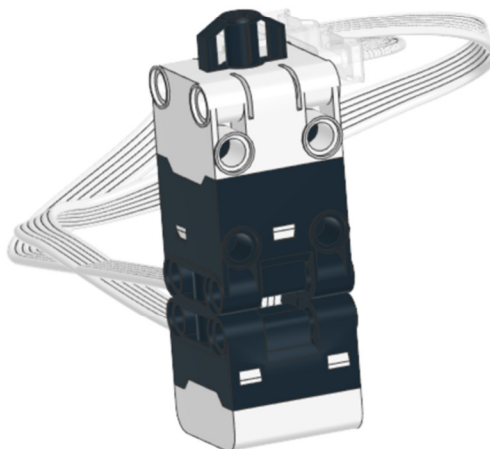
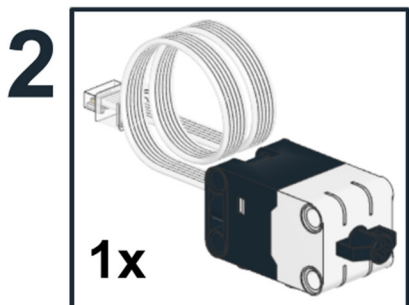
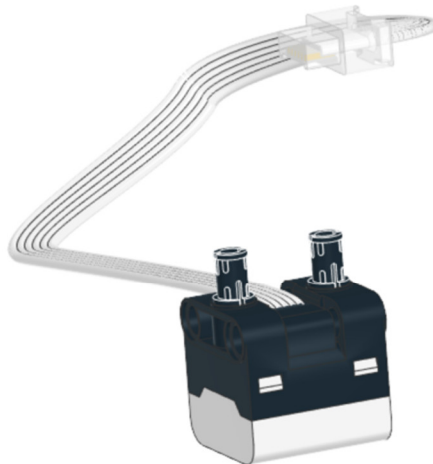
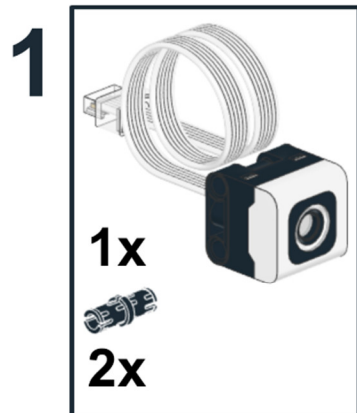


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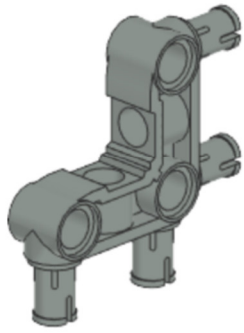


SPYKEE Base Completed!

Sensor Stack Module



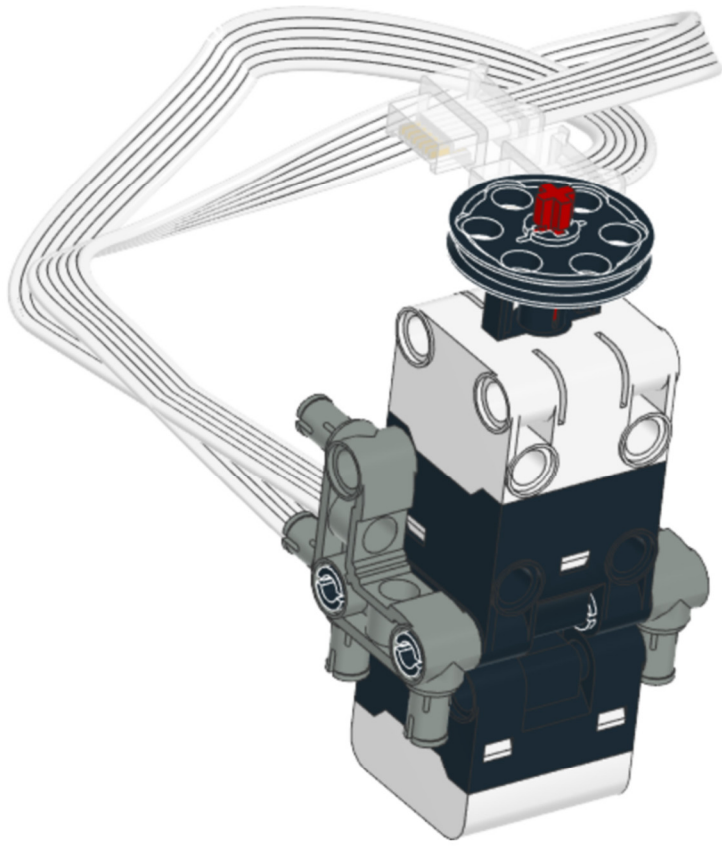
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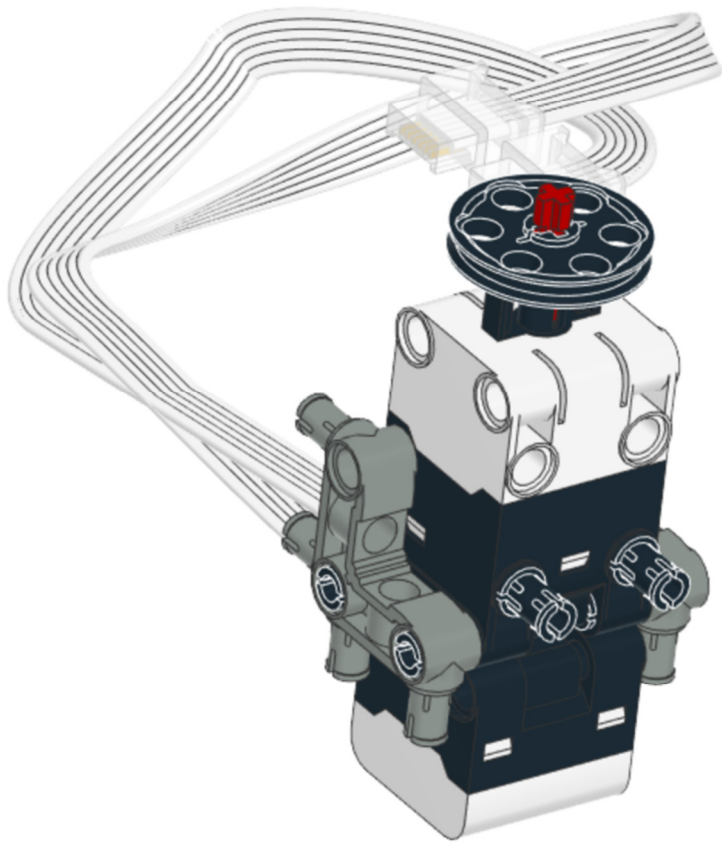
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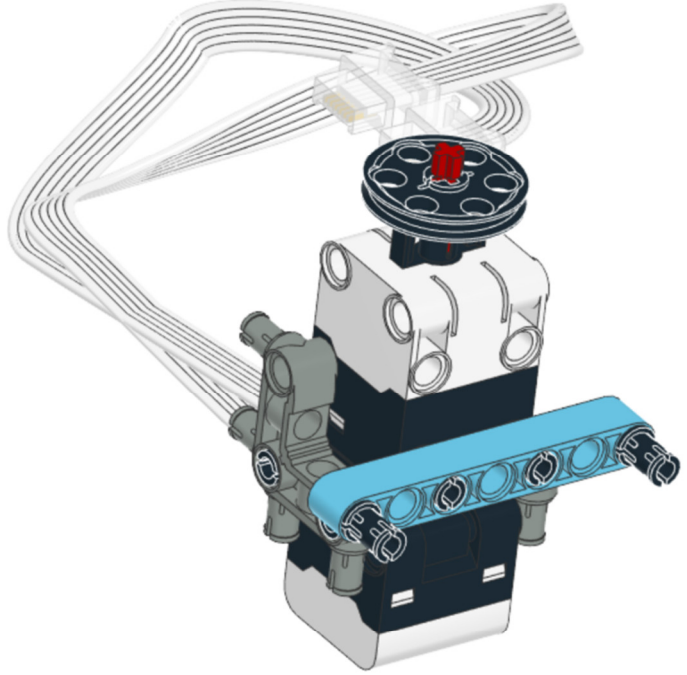
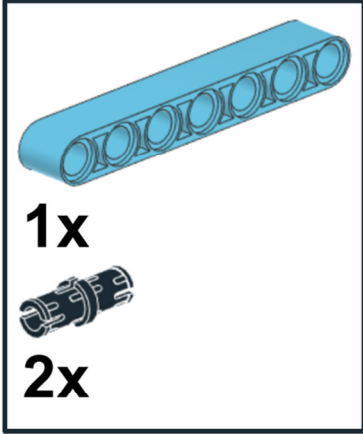
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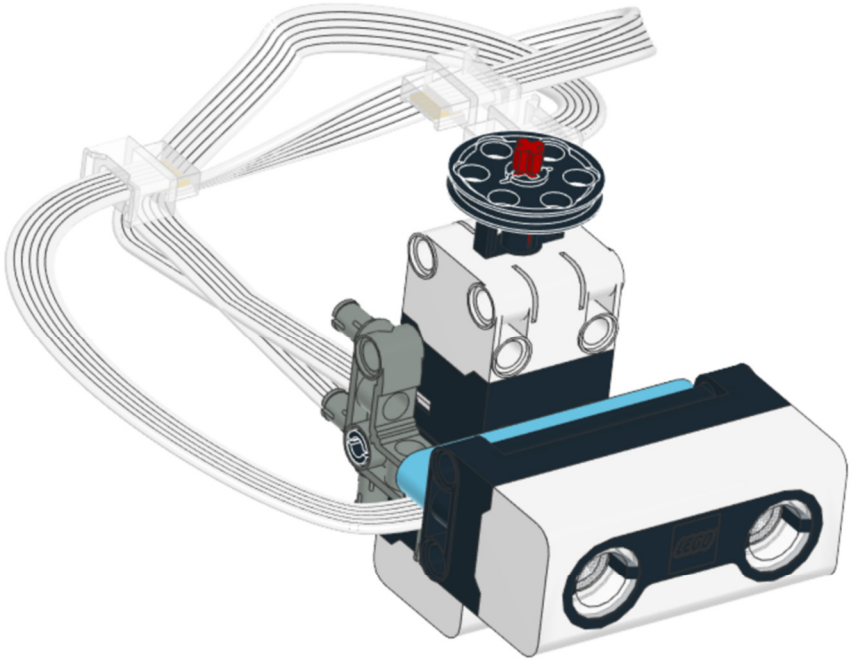
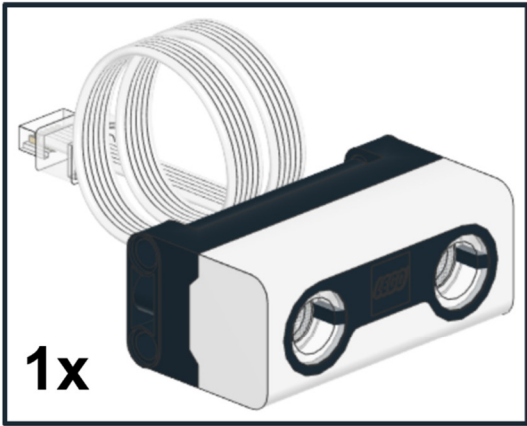
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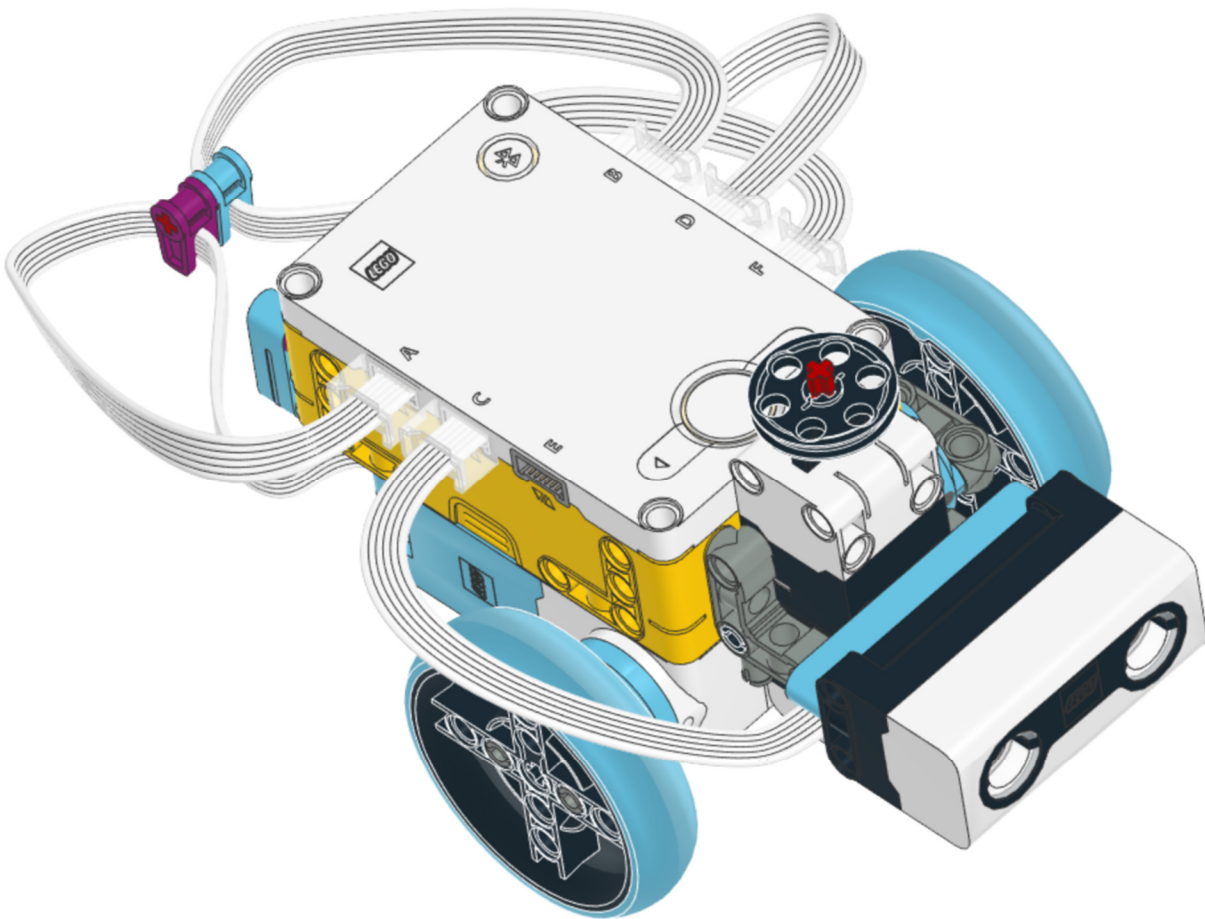


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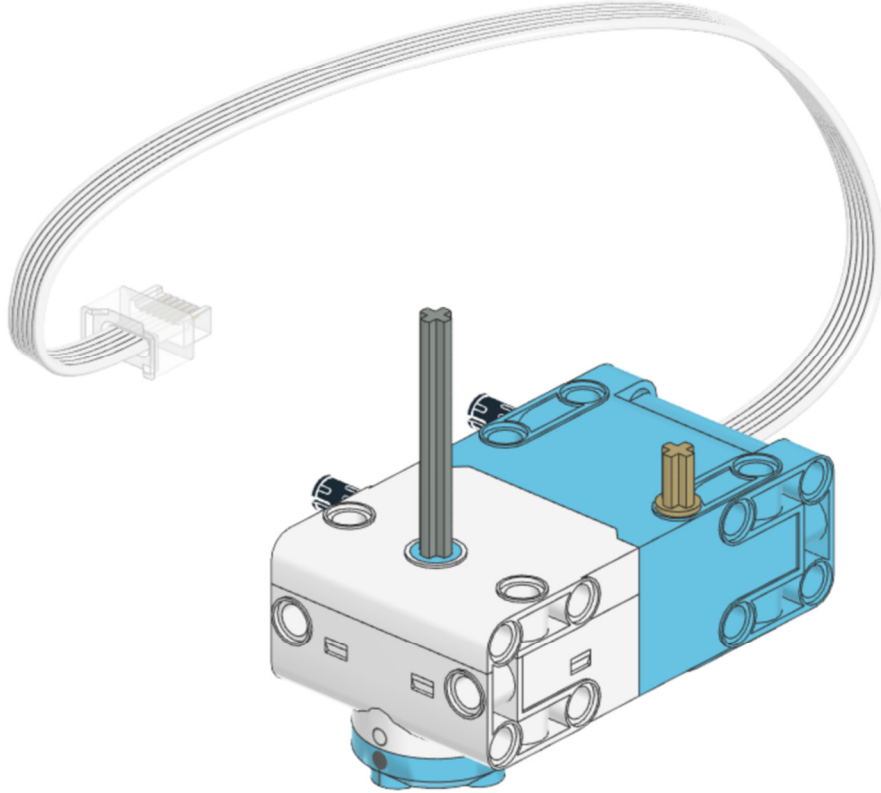
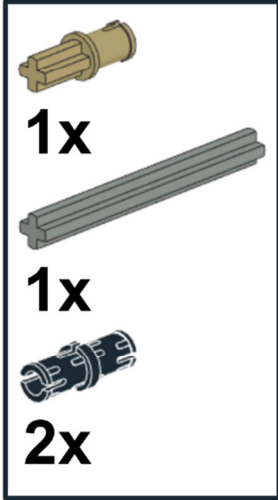
Attach to the front of the Base

- Distance – Port C
- Color – Port D
- Force – Port F

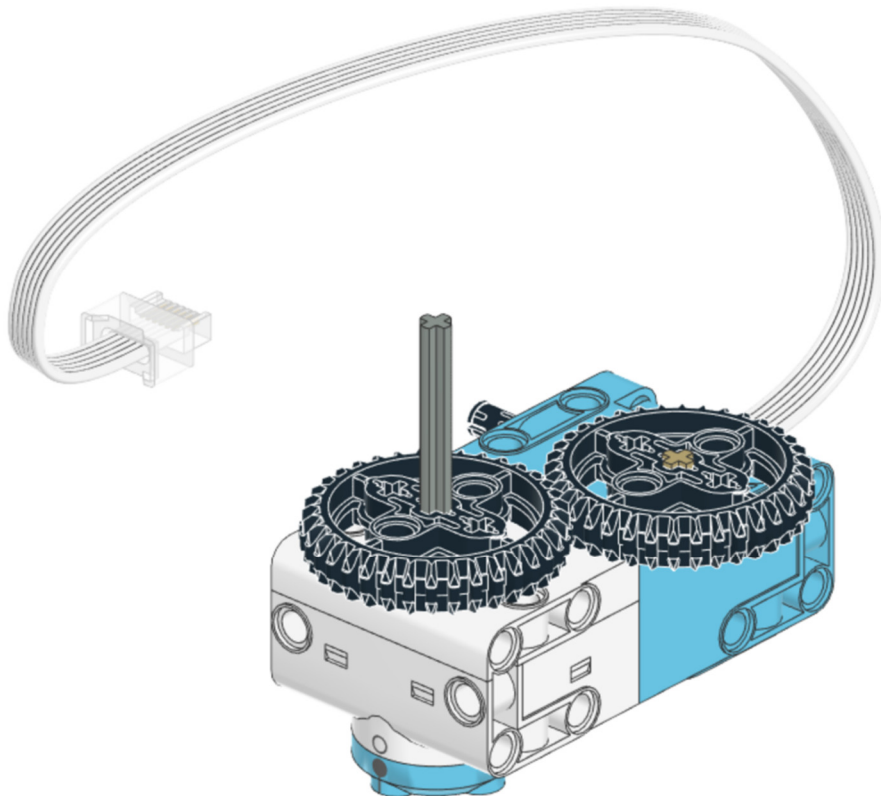


Gripper Module

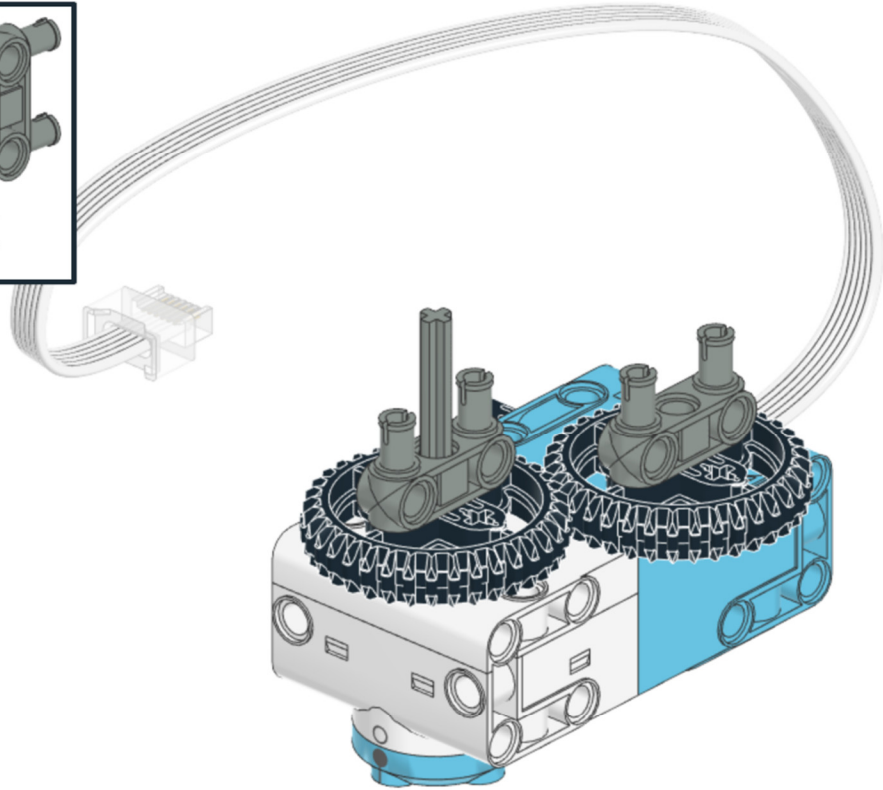
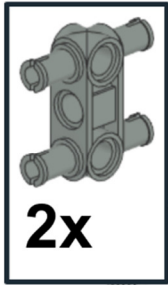
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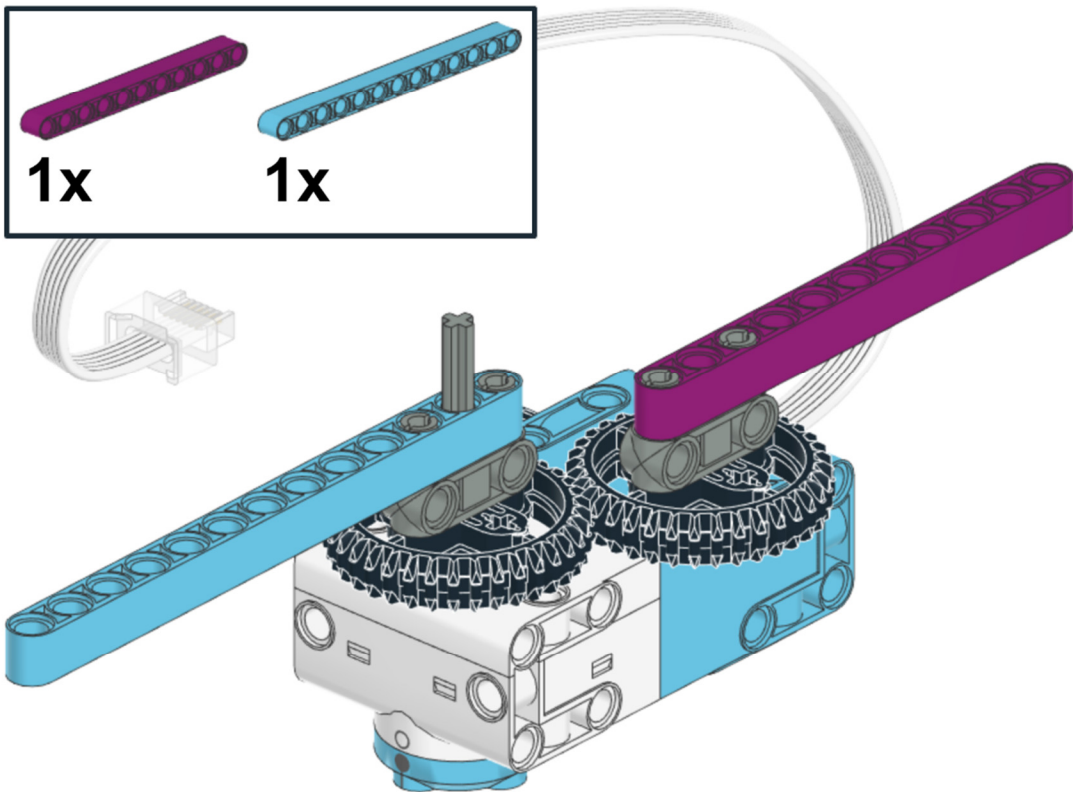
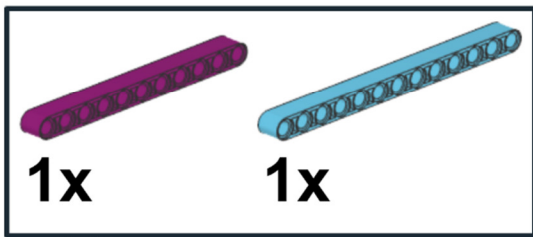
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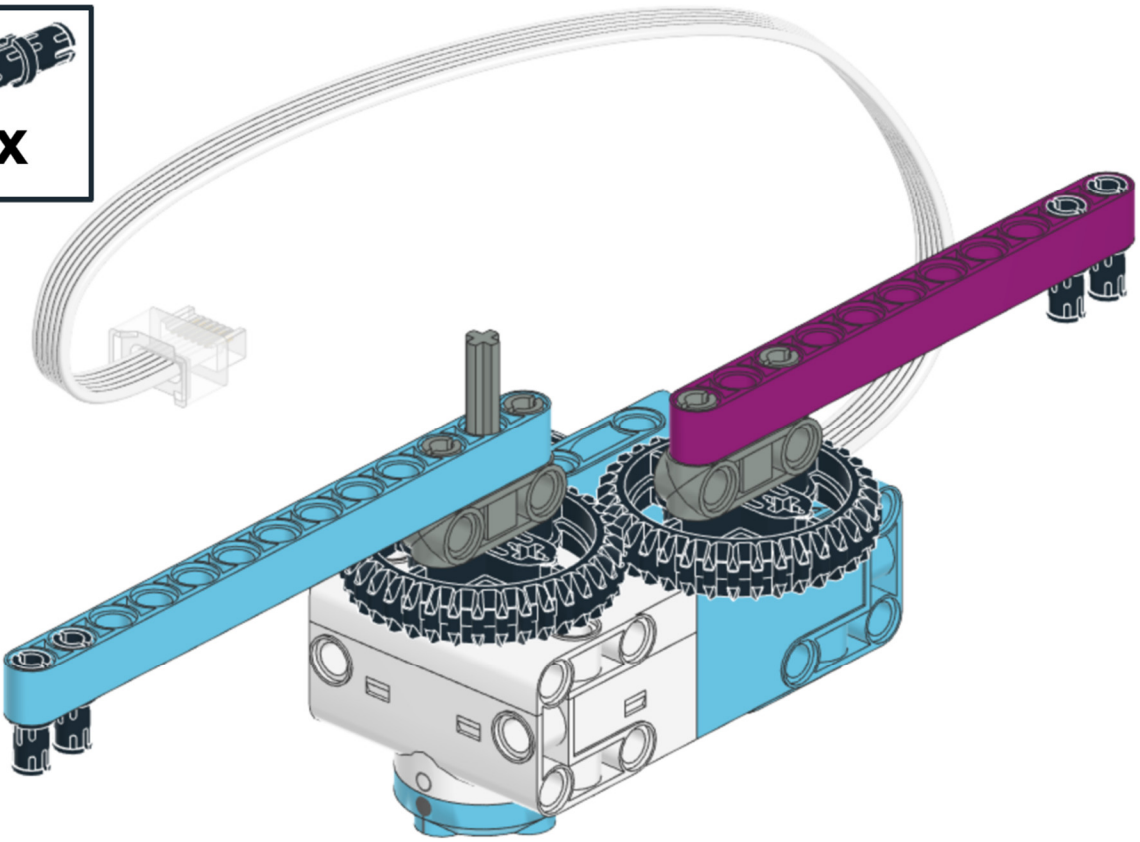
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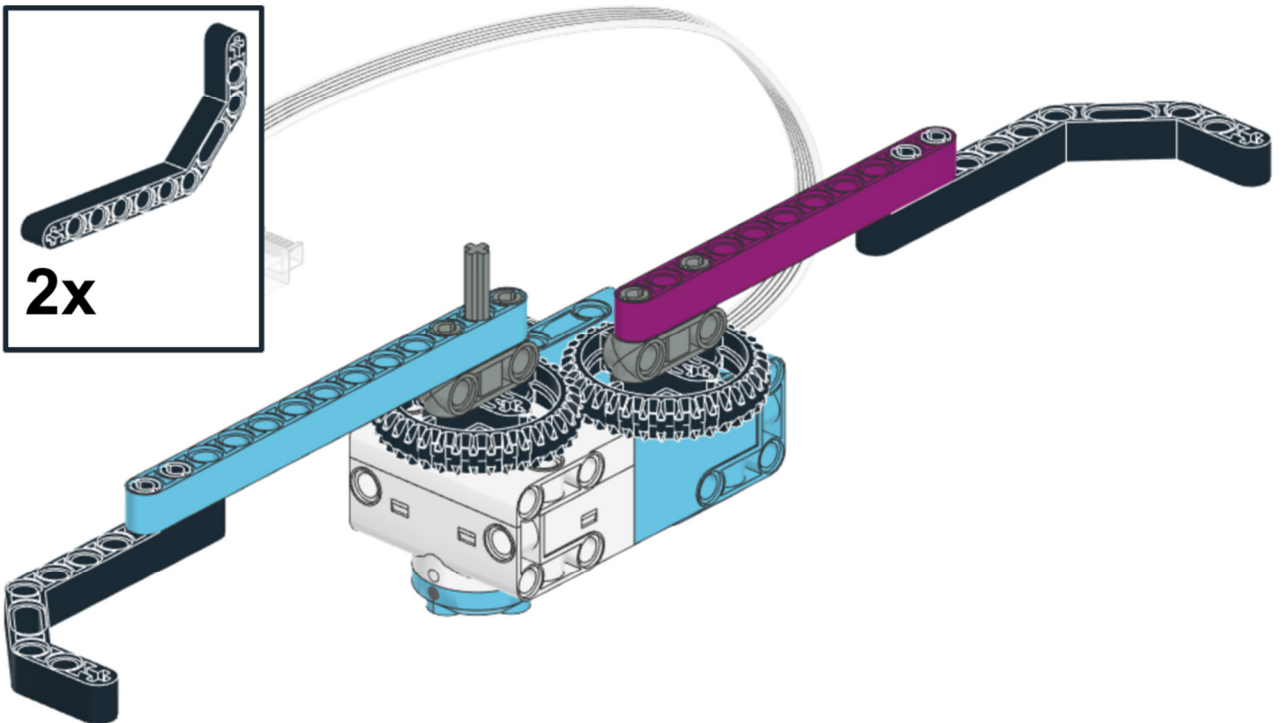
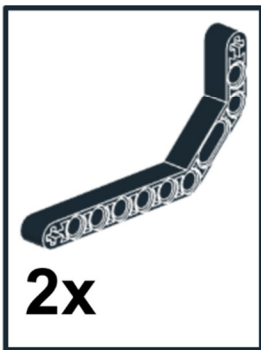
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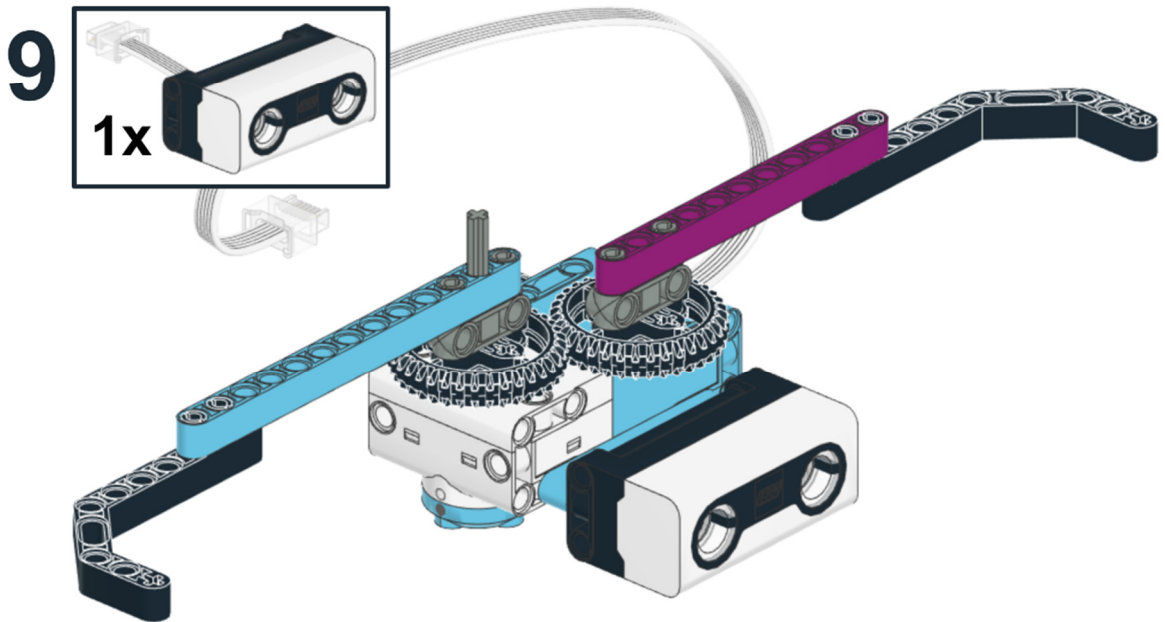
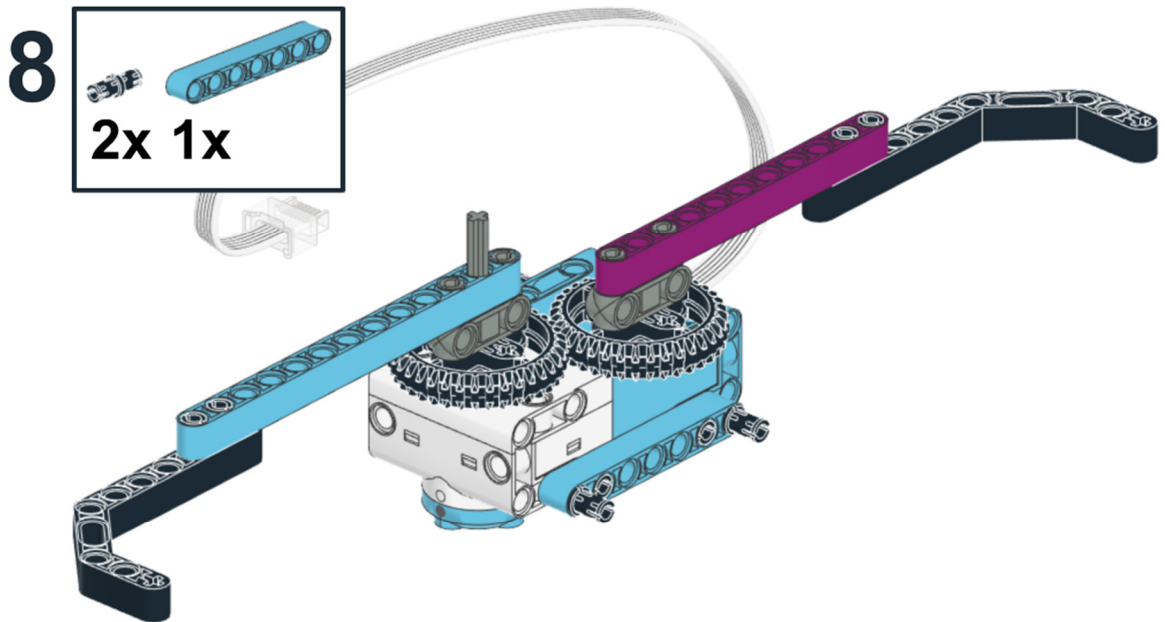
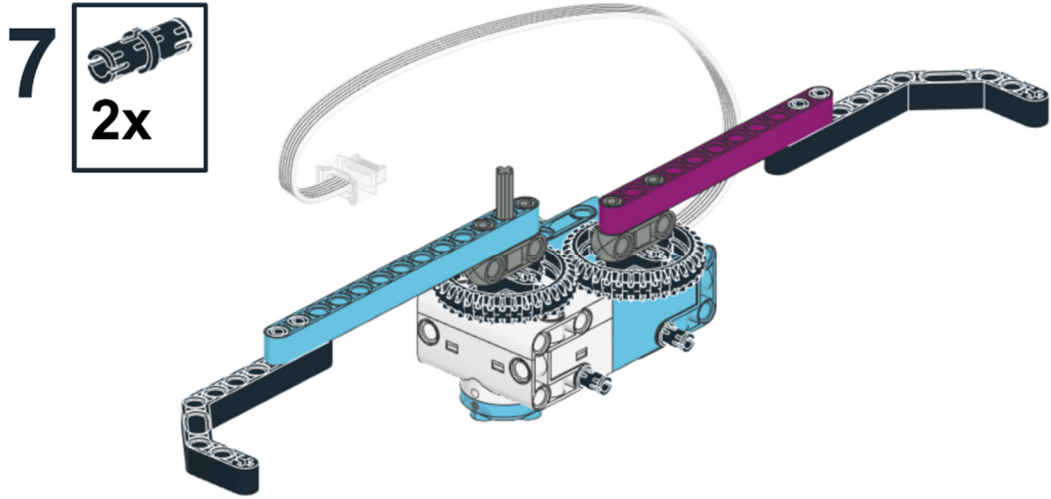


5



6





Attach to the front of the Base

- Distance – Port C
- Gripper – Port E

