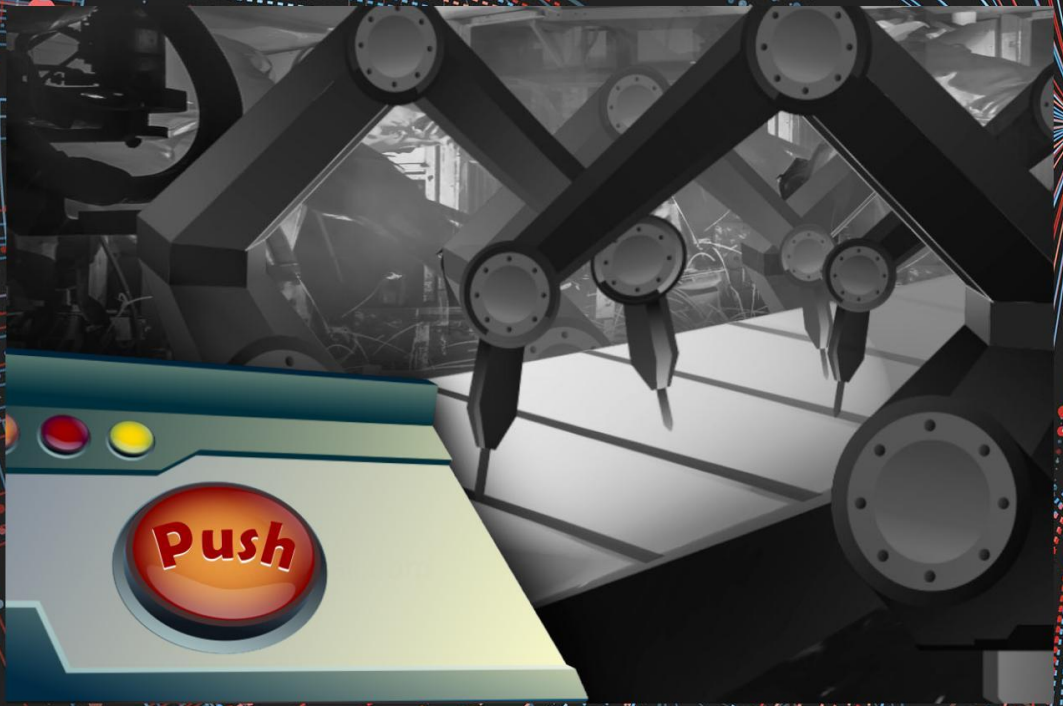
Falling meteorite

Base on Mars



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2

Base on Mars

Hello everyone!
Today we woke up to a small earthquake. But it turned out that a large meteorite fell very close to our base! Usually, the study of meteorites provides information about the formation of stars and planets, and therefore meteorite samples can be very valuable. Mars has no atmosphere, so robots will be responsible for collecting samples

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TASK

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TASK

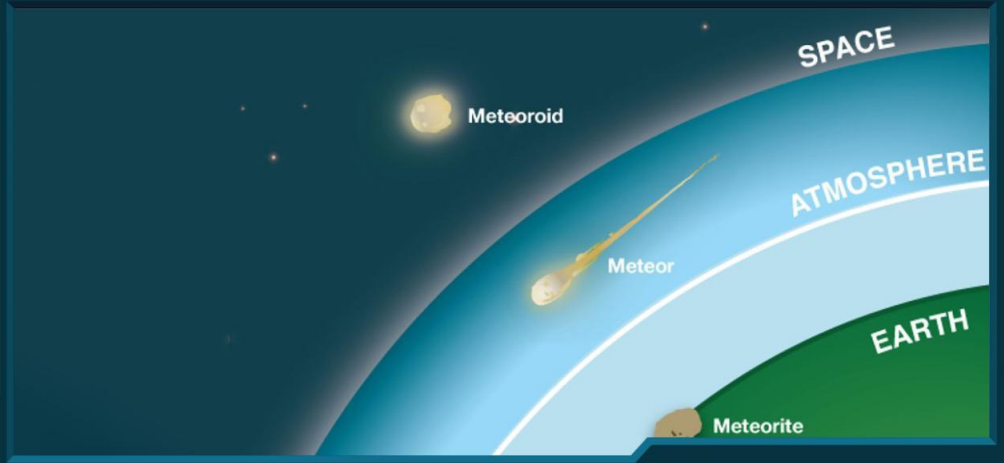
- collect samples of meteorite debris that fell near the base

Steps

- learn about how the composition of meteorites tells the story of the universe
- build and program a robot
- collect meteorite samples and deliver them to the base for study

Meteorites and asteroids

These two concepts are often confused. Asteroids are celestial bodies that orbit the Sun. And meteorites are bodies that fell to the Earth's surface from space. Small asteroids become meteors - bright flashes in the sky



Meteor streams

Meteors create very beautiful pictures in the night sky. There are periods when the Earth passes through a denser flow and these flashes become very noticeable and frequent. One of the most powerful meteor showers is called the Perseids. It becomes most visible from August 8 to 14

Task discussion

When was the last time you watched the night sky?
What planets, stars or constellations do you know?

Meteorites

According to various estimates, 5-6 tons of meteorites fall to Earth every day. And these are only those that can be found and explored. And dust settles in general from 300 to 20,000 tons. Most meteorites weigh from a few grams to several kilograms

Meteorites

In addition to relatively small meteorites, there are real record holders. The largest is considered to be the Goba meteorite, which fell about 80 thousand years ago on the territory of modern Namibia. It has dimensions of 2.95*2.84 m, and the height varies from 0.5 to 1.2 m. The weight of this giant is about 60 tons

Meteorites

According to their content, meteorites are divided into three large categories. Most of all stone meteorites (92 out of 100), iron-stone meteorites occur only 2 out of 100 and the rest (6 out of 100 found) are iron meteorites. By the way, Goba also belongs to iron meteorites.

Meteorites

The study of meteorites can give very interesting results. For example, during the study of the Acfer 086 meteorite, the amino acid glycine was found, which was also part of an extraterrestrial protein. This is not yet extraterrestrial life, but the first brick to it. It is said that such compounds could have formed 4.6 billion years ago.

Meet the Reaper!

This four-wheeled robot can collect meteorite samples and distinguish them by size!

Reaper

Design features

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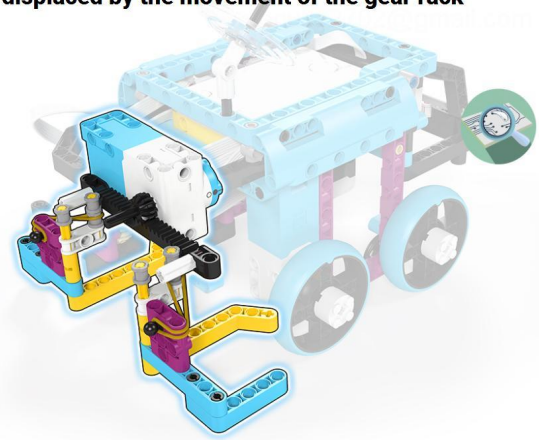
The robot is driven by two middle servomotors. A large servo motor is used to drive the manipulator. The color sensor is used for movement along the line, and the distance sensor is used for object recognition

Find:

- **Smarthub**
- **Motors**
- **Color sensor**
- **Distance sensor**

Design features

In order for one motor to independently drive two beams, rubber bands are used. They hold the beams in the main position, from which they are displaced by the movement of the gear rack



Find:

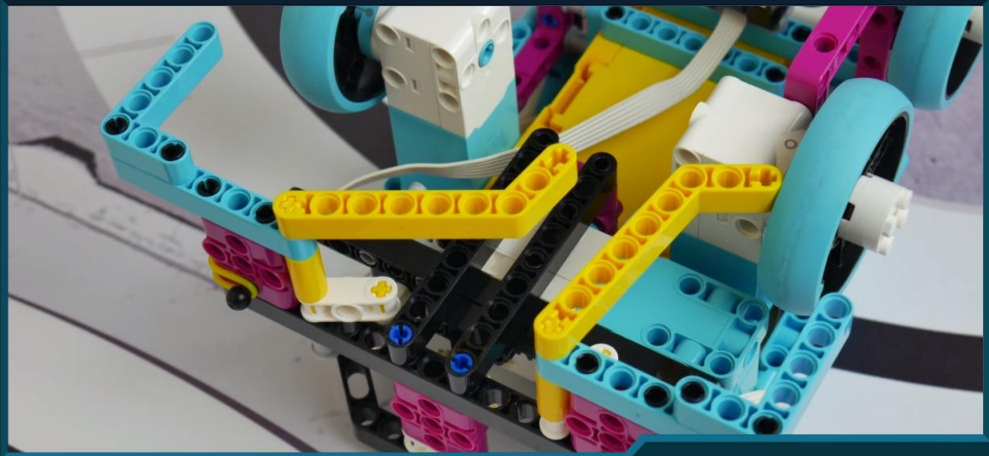
- **toothed rack**
- **manipulator beams**
- **rubber bands**

Design features

The toothed rack turns the rotation of the motor into translational motion. The parts attached to it deflect the left and right parts of the manipulator

Design features

When the direction of rotation of the motor changes, the part of the manipulator that captures objects changes. In the central position, the beams do not touch objects and the robot can pass them by moving along the marking line



Design features

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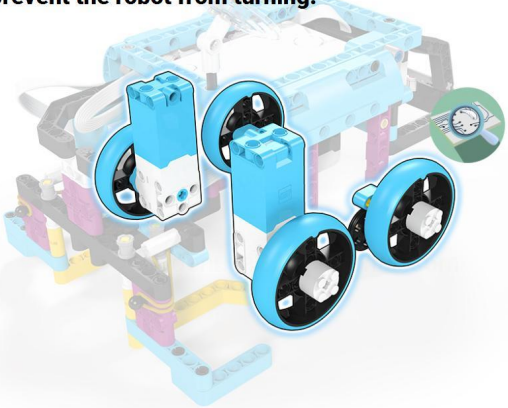
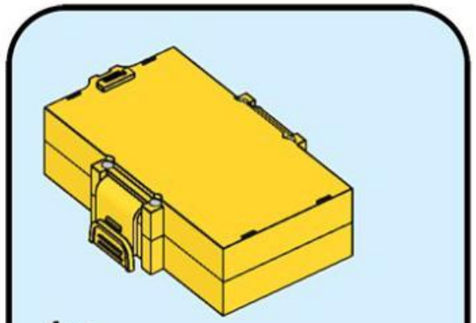
The rear wheels of the robot are driving, and the front wheels play a decorative role. In fact, the robot has two support wheels of small diameter that do not have tires. Thanks to this, the support wheels do not prevent the robot from turning.



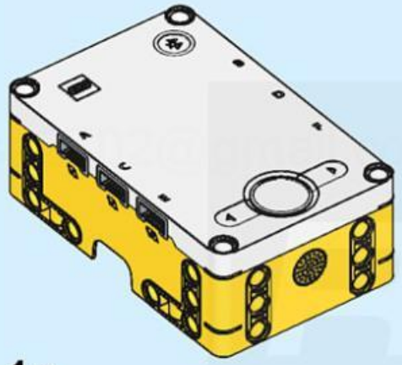
Find:

- **Medium motors**
- **Drive wheels**
- **Supporting wheels**

Build a robot!



1x



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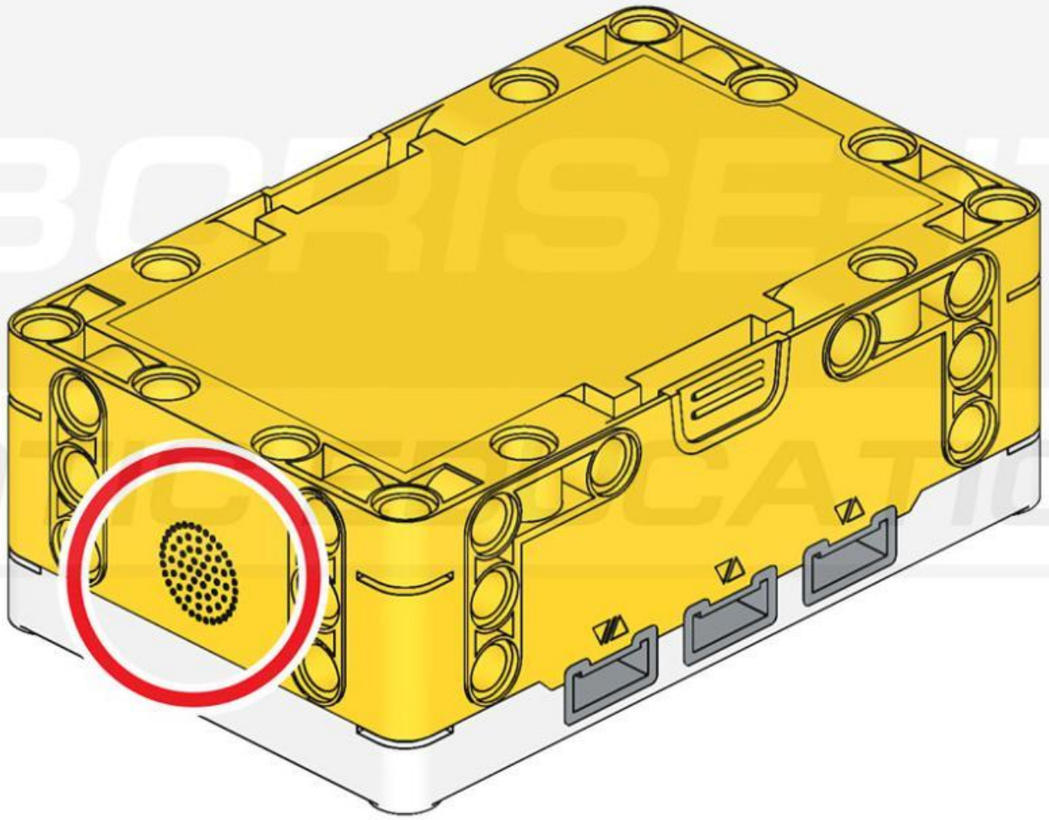
1



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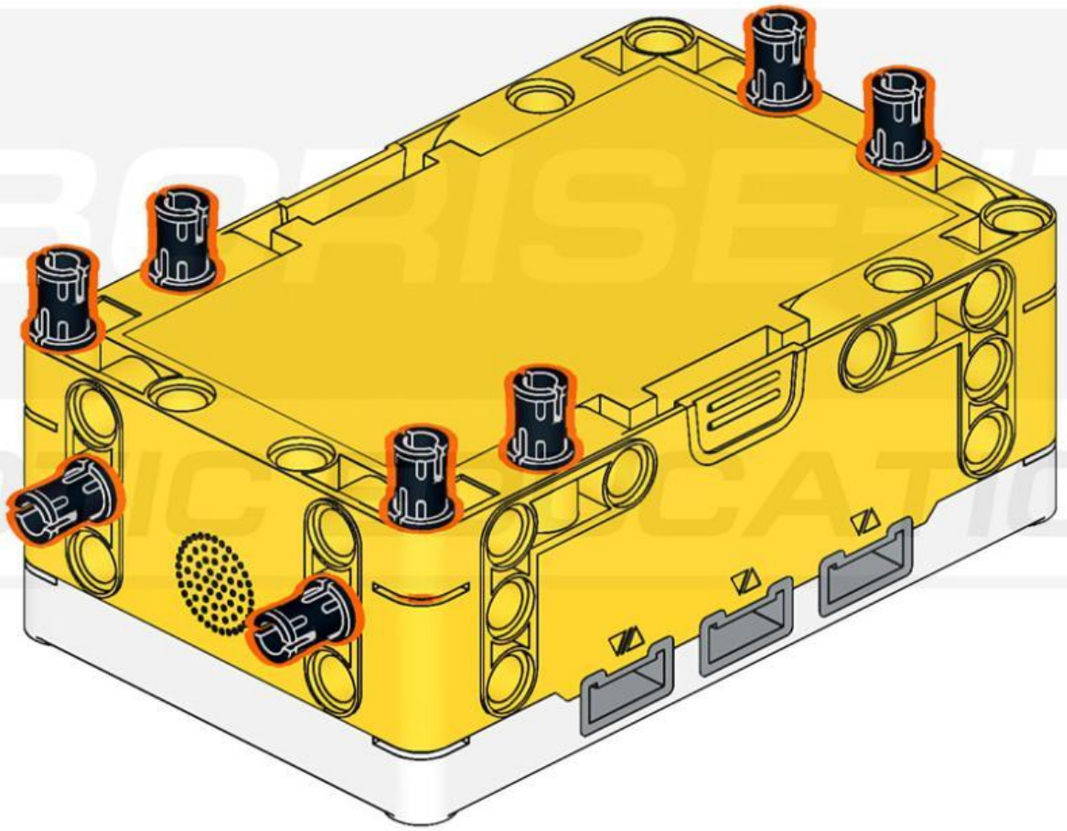

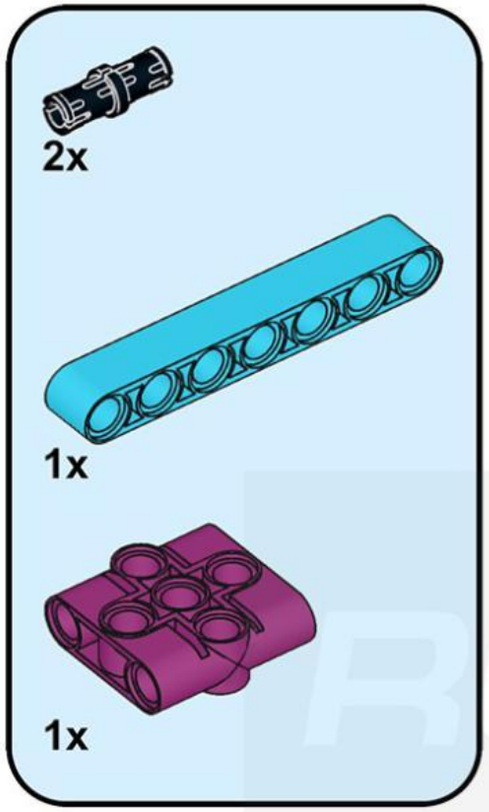

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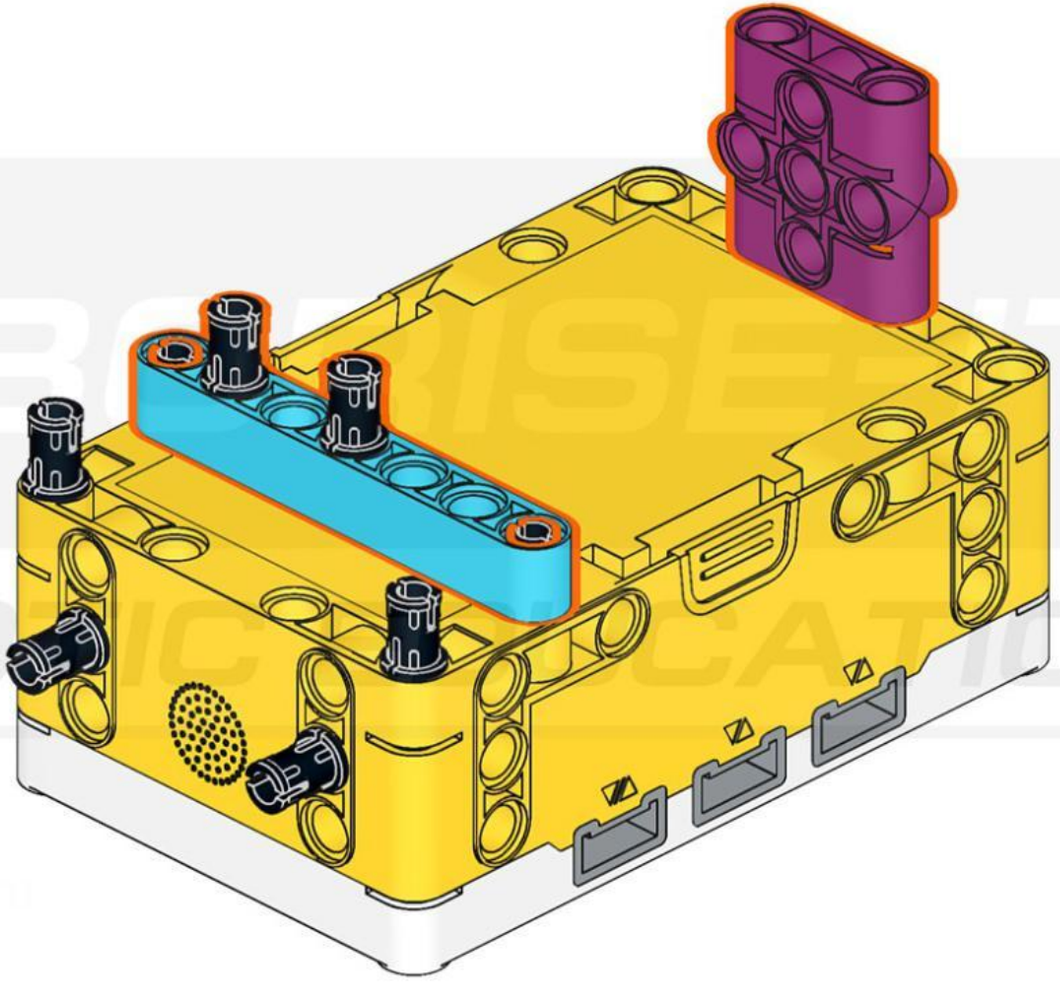

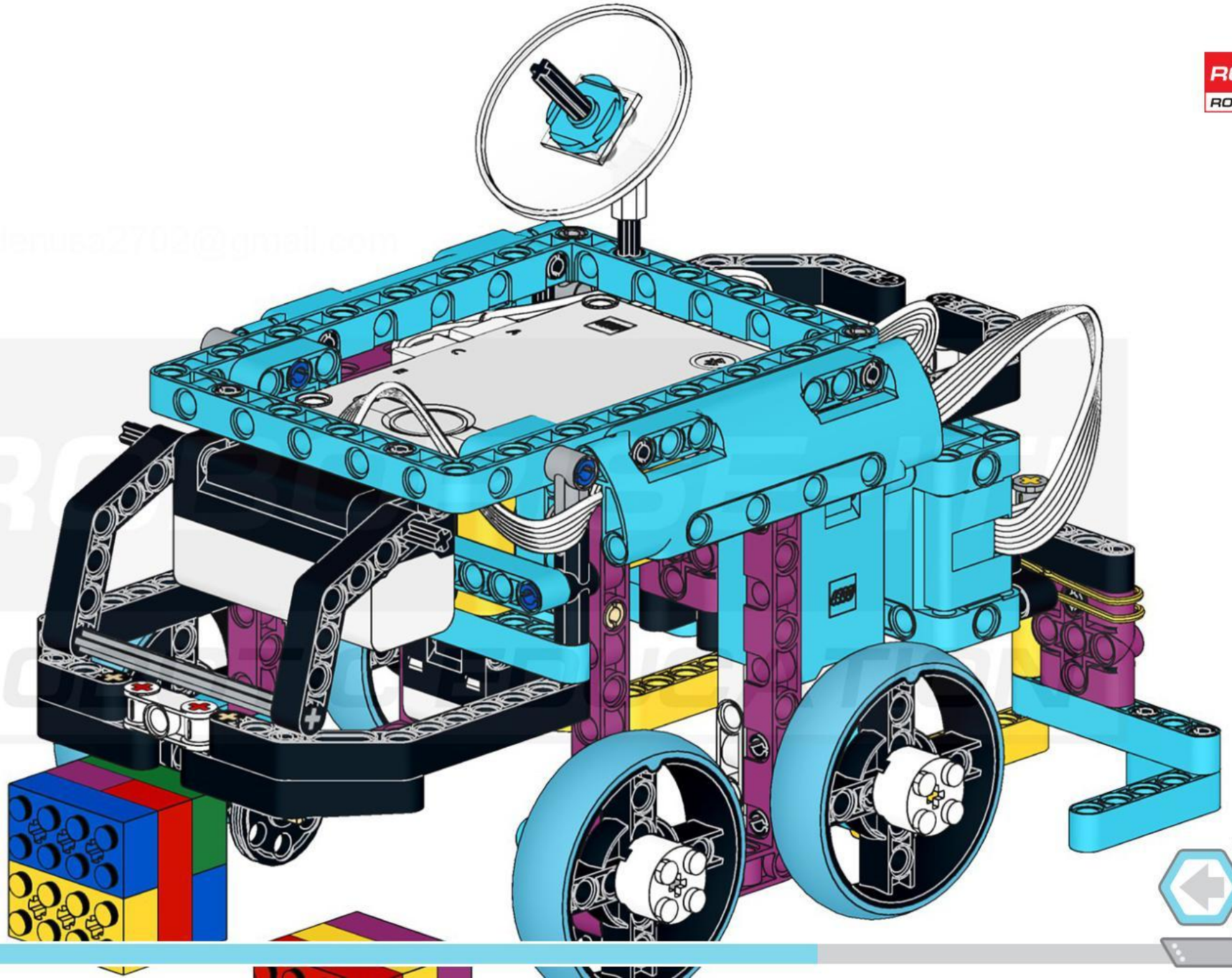

Check it out!

The cables must not rub when the robot is moving!

Task

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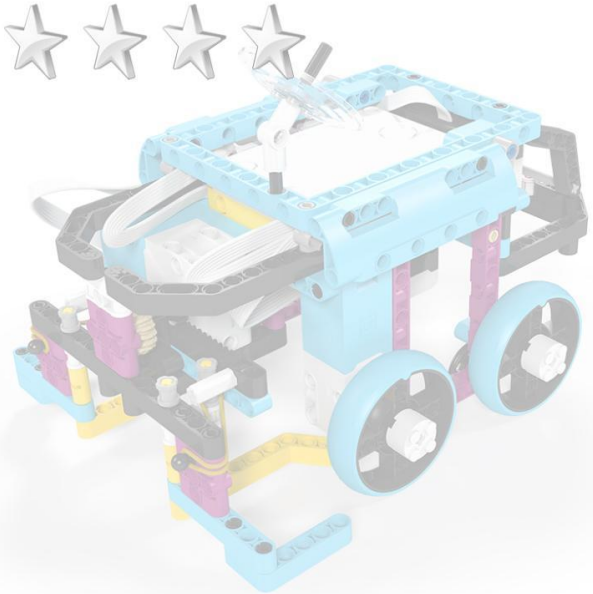
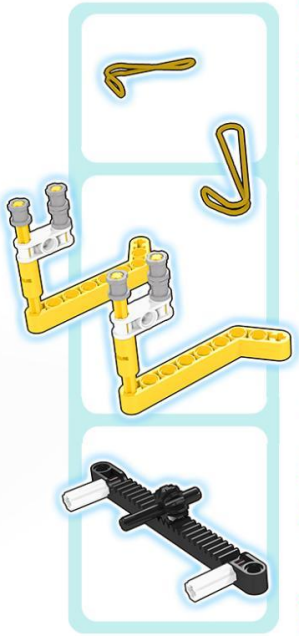
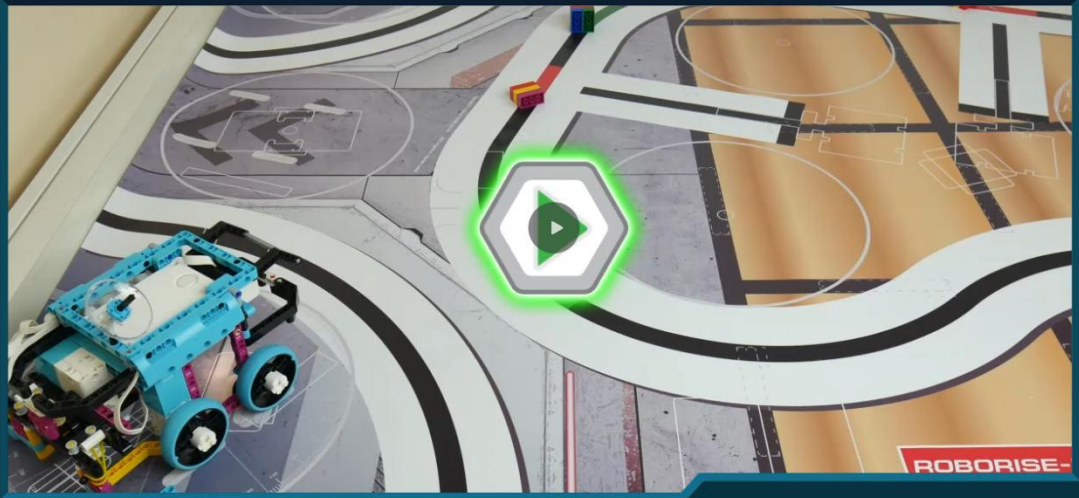
Place the parts of the robot in the correct places





Task

After the meteorite falls, we will use robots to collect samples. At the same time, it is possible to program the collection of samples of any size, or to collect only large or only small fragments of meteorites.



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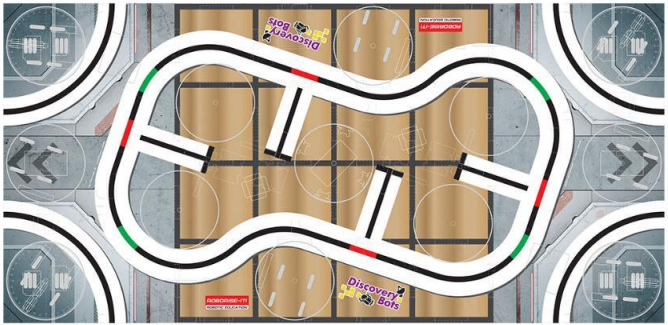
Task field

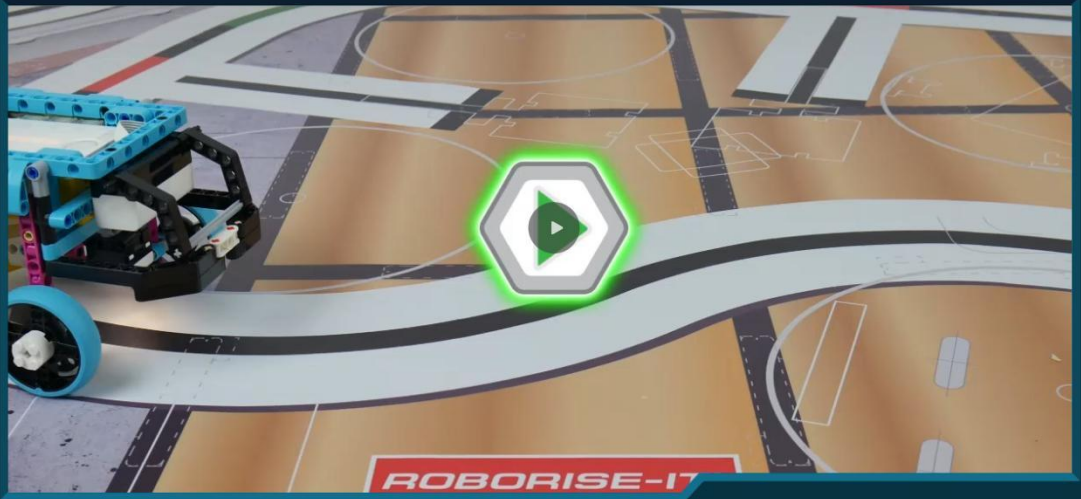
Take a look at the field assigned to the tasks in this course. It has markings that will help you correctly place objects for tasks, as well as markings for the movement of the robot itself. At the same time, tasks can be performed by two, and sometimes four teams!



Please note that if the field is printed in such a way that the robot sensor does not correctly detect the colors, you can cover the corresponding areas with self-adhesive films "Oracal"

Task 1

Program the movement of the robot along the marking line. This is how you indicate to it the route for collecting samples



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Task 1. Program

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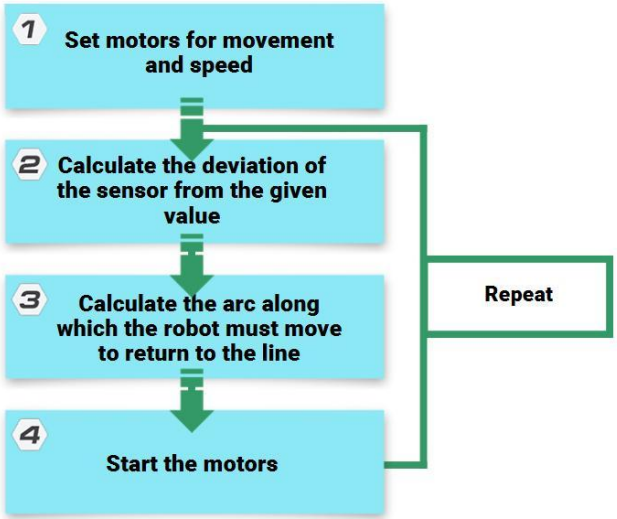
Algorithm | Program

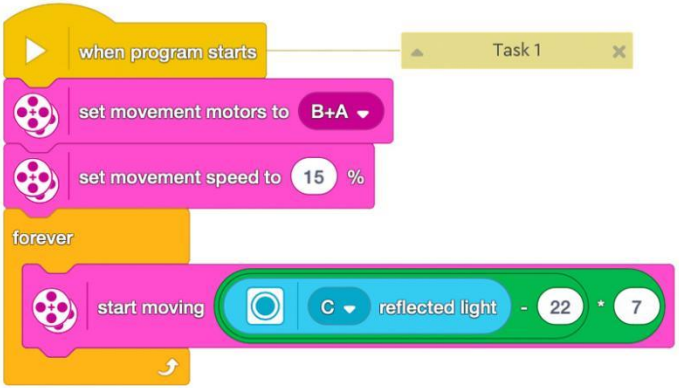
The robot movement algorithm along the marking line using a proportional regulator is as follows:



Task 1. Program

Algorithm | Program

The program may look like this:



Task 2

Add departure from the base to your program. The robot must find the marking line and stop in a position convenient to continue moving along it.

Task 2. Program

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Algorithm | Program

The algorithm for leaving the marking line can look like this:

1. Set motors for movement, speed and travel distance in 1 turn
2. Drive 30 cm and start moving forward
3. Wait a reduction in reflected light value of less than 22%
4. Stop the motors

Task 2. Program

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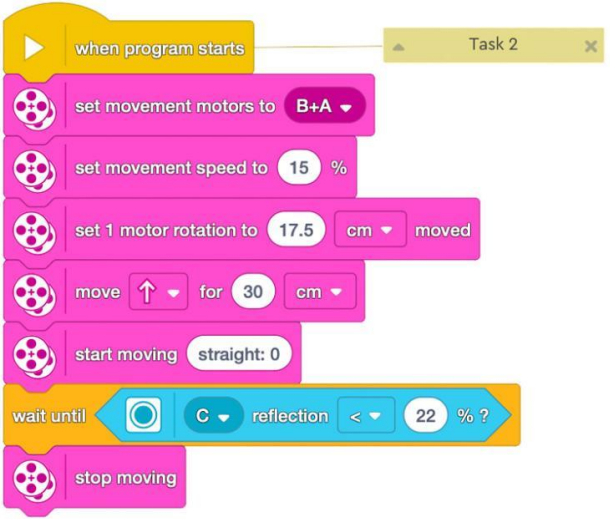
Algorithm | Program

The program may look like this. Please note that journey times may differ when starting from another base!



Task 3

Combine the two previous programs and test them. The robot must leave the base, find the marking line and continue moving along it

Task 3. Program

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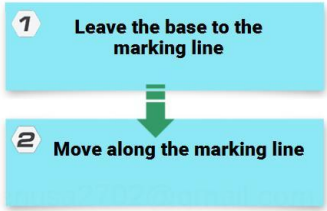
Algorithm | Program

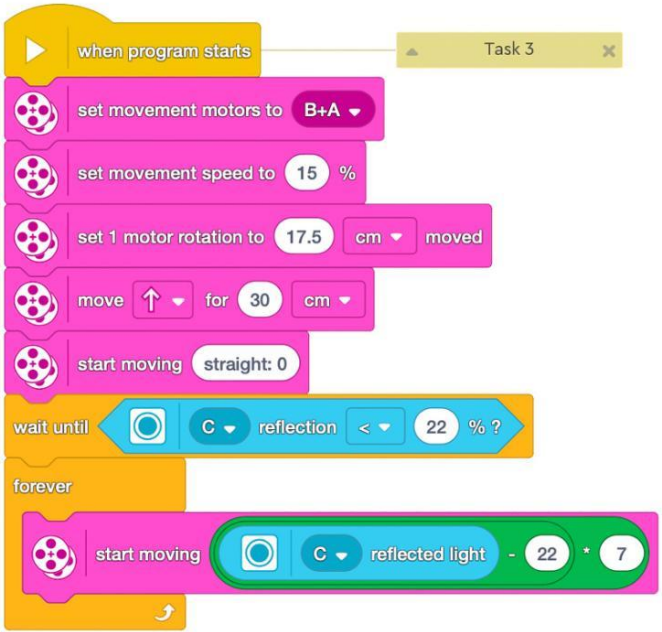
To perform the assigned task, the program must work according to the following algorithm:



Task 3. Program

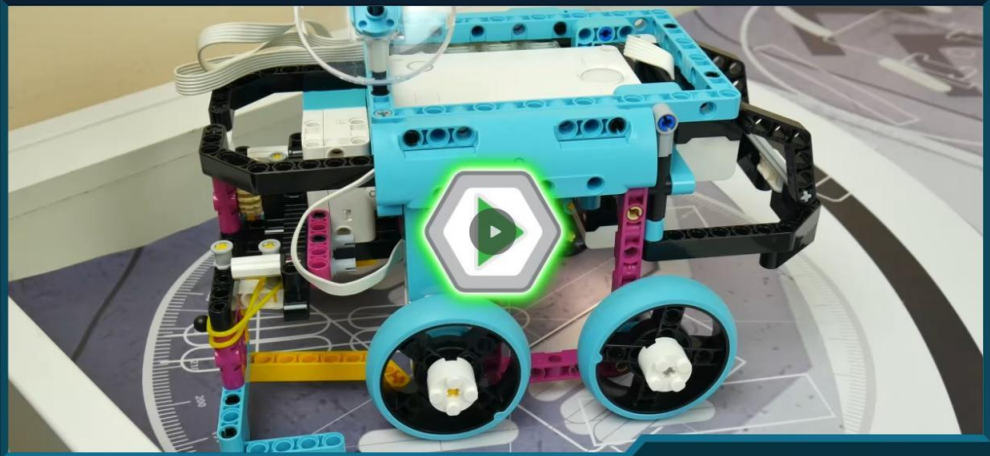
Algorithm | Program

The combined program looks like this:



Task 4

Your robot is ready to work with meteorite samples. To be able to capture them, program the manipulator calibration. In the central position, the manipulator beams should pass through the samples and not displace them during movement



Task 4. Program

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Algorithm | Program

The calibration algorithm can be as follows:

1. Move the manipulator to the extreme left position
2. Reset the motor speed sensor data
3. Move the manipulator to the extreme right position
4. Calculate the central position and transfer the manipulator to it

Task 4. Program

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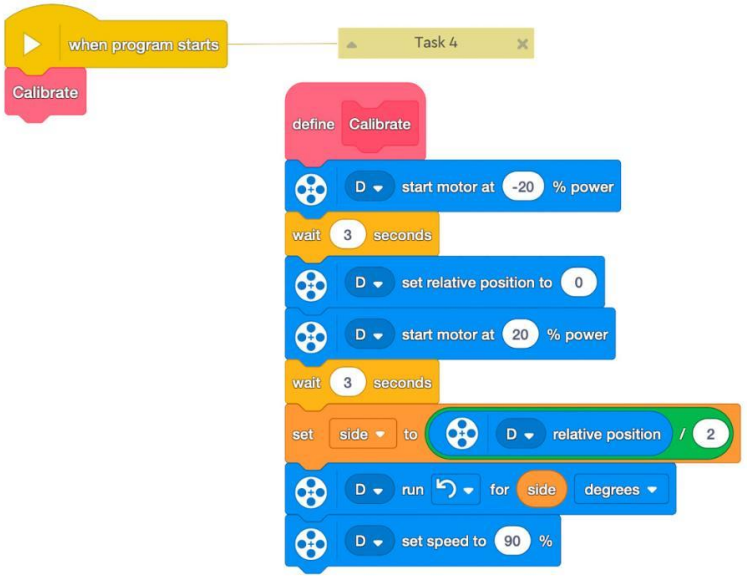
Algorithm | Program

Create a 'My block' for convenient use of the calibration program:



Task 5. Program

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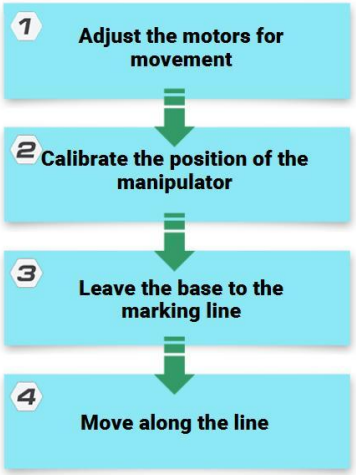
Algorithm | Program

The algorithm can be as follows:



Task 5. Program

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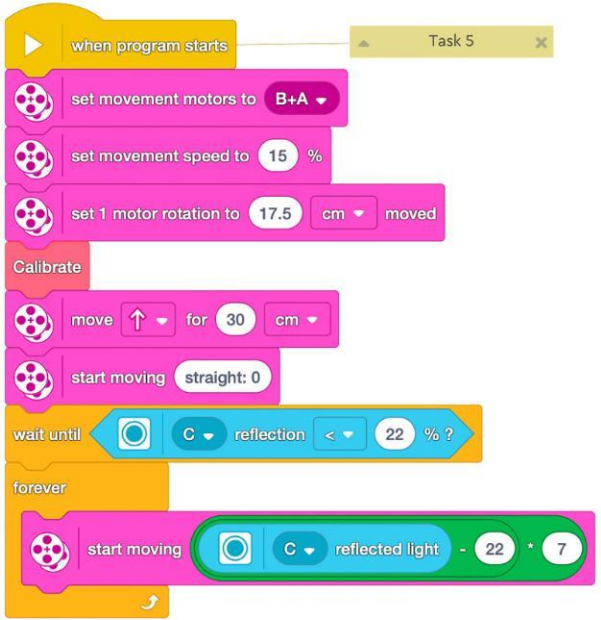
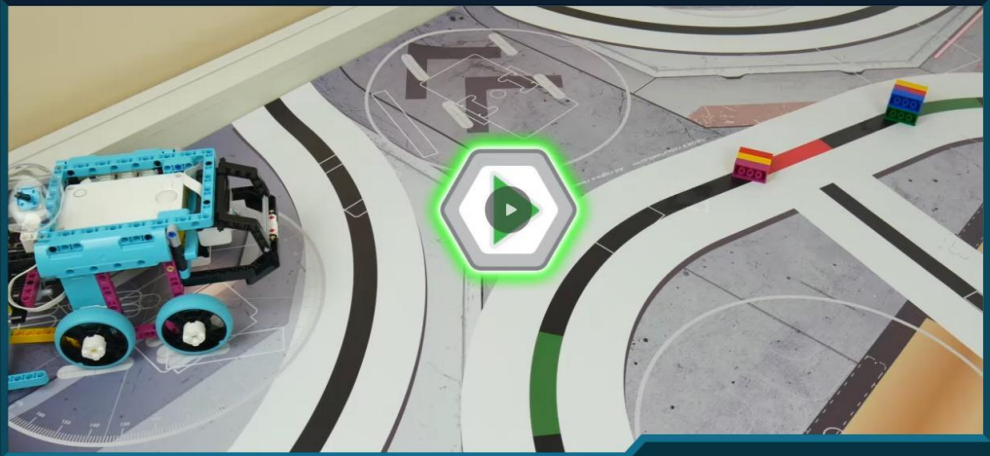
Algorithm | Program

The modified program looks like this:



Task 6

Add tracking of the presence of meteorite debris on the robot's trajectory and the corresponding reaction in the form of changes in the proportional controller.



Task 6. Program 1

Algorithm | Program

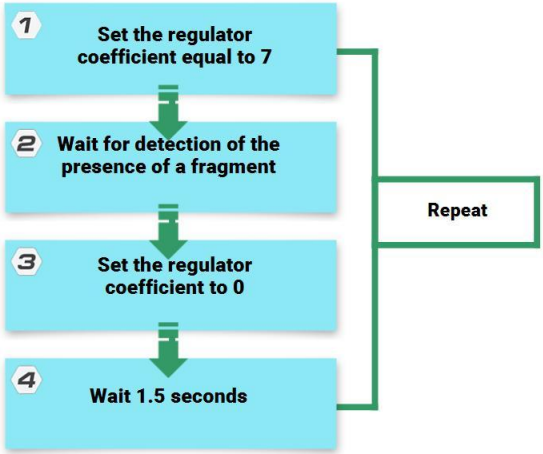
Add proportional controller control via variable value and sending a message to start tracking for debris:

Task 6. Program 2

ROBORISE-IT!
ROBOTIC EDUCATION

Algorithm | Program

The algorithm for responding to the presence of debris on the trajectory can be as follows:



Task 6. Program 2

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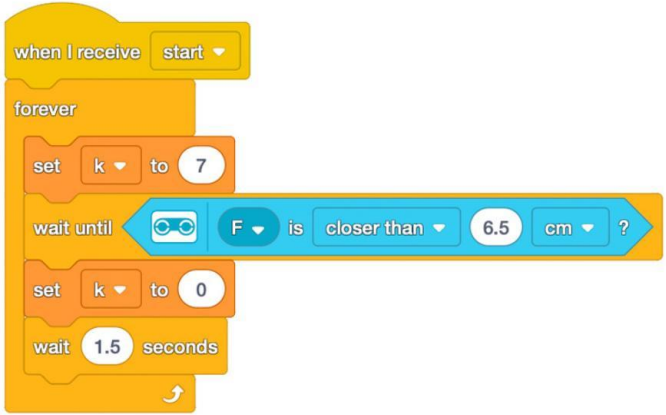
Algorithm | Program

According to the following program, the robot will drive along the line with a coefficient of 7, and when detecting a fragment, it will shake hands for 1.5 seconds straight (the coefficient is equal to 0).



Task 7

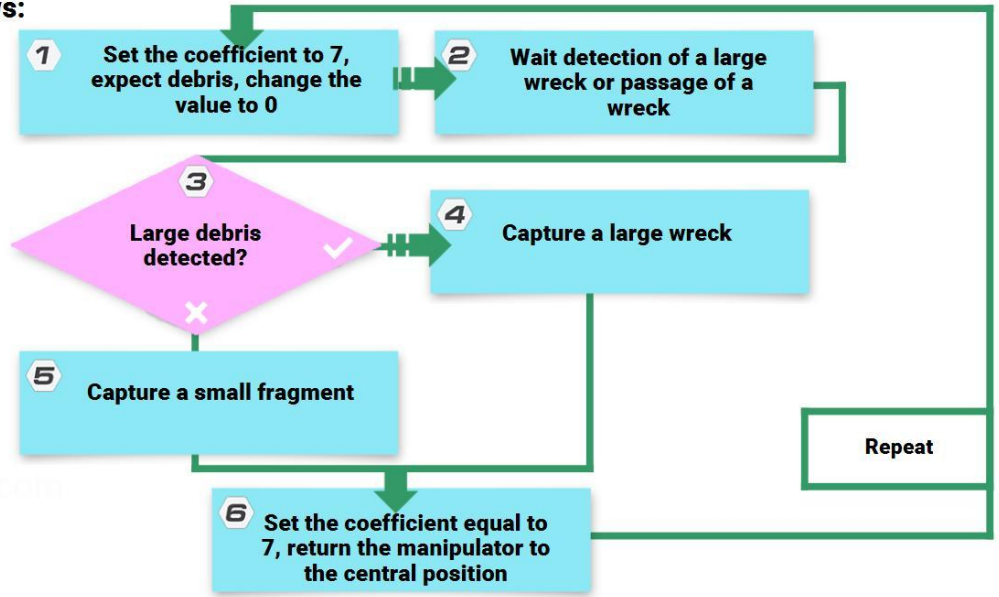
Program the collection of meteorite fragments. Large and small debris should go to different compartments.

Task 7. Program

ROBORISE-IT!
ROBOTIC EDUCATION

Algorithm | Program

The algorithm for responding to the presence of debris on the trajectory can be as follows:



Task 7. Program

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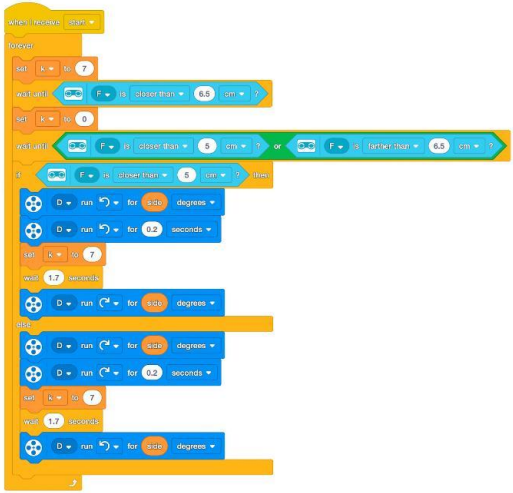
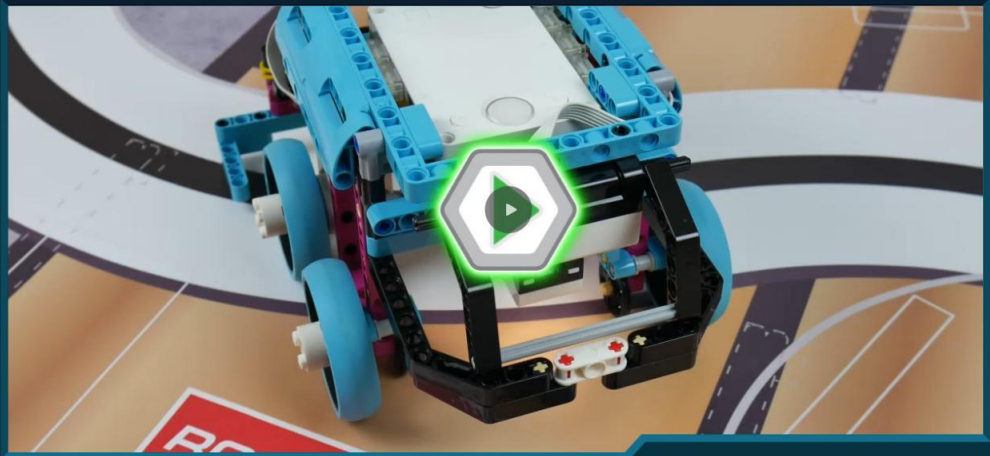
Algorithm | Program

The updated program may look like this:



Task 8

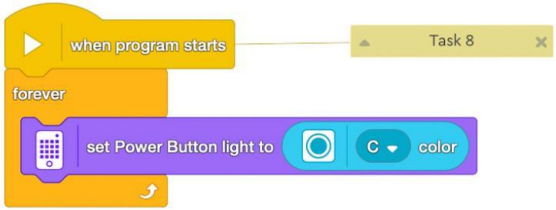
To determine the position of the robot on the line, there are red and green color zones. Check if the color sensor can detect the color of these zones from the height at which it is placed.



Task 8. Program

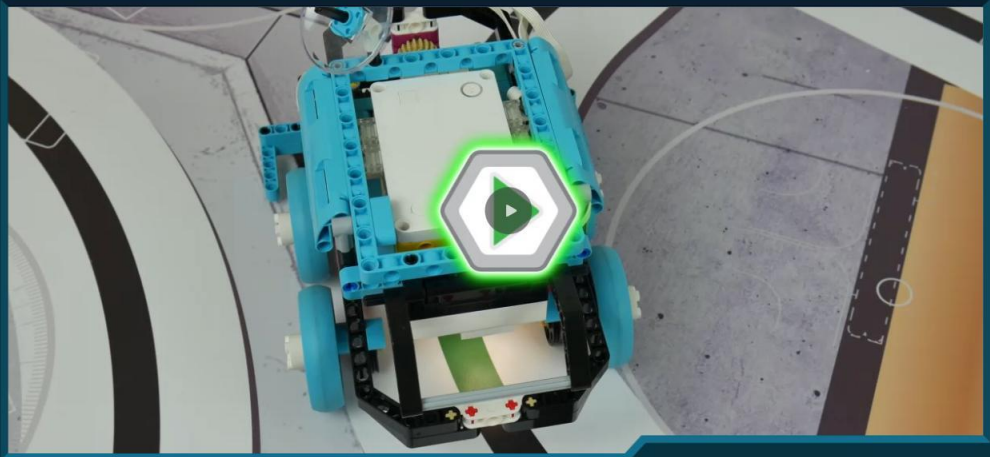
Algorithm | Program

The test program may look like this:



Task 9

To determine the color from such a Vistana, you can use the reading of the color components (green, blue and red). If the reflected signal is dominated by a red component, then most likely the sensor is aimed at a red surface, etc.



Task 9. Program

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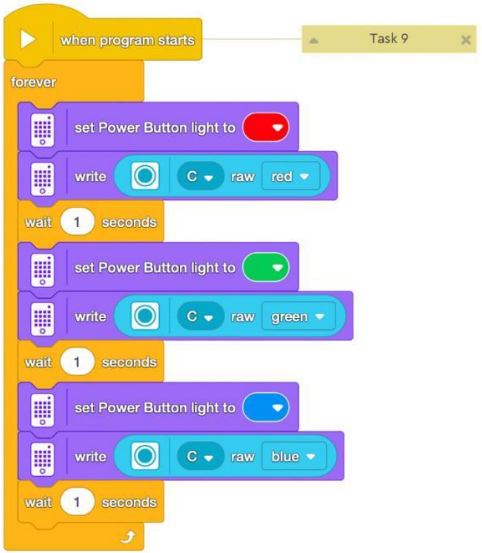
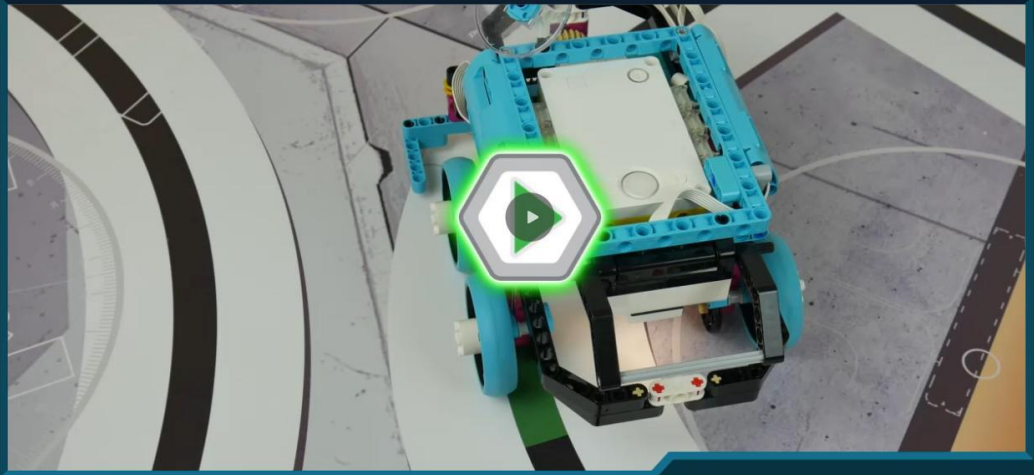
Algorithm | Program

The test program may look like this:



Task 10

To complete the movement along the marking line, the robot must be able to count the number of green zones it passes. Test the following program to see if the robot 'sees' the green area and adjust it as needed



Task 10. Program

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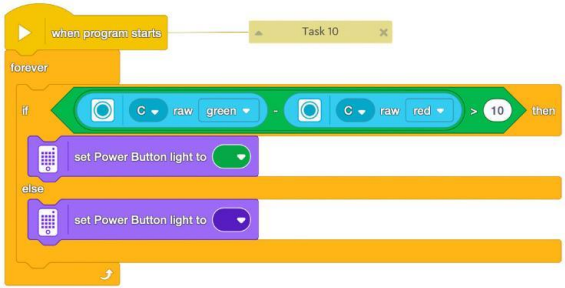
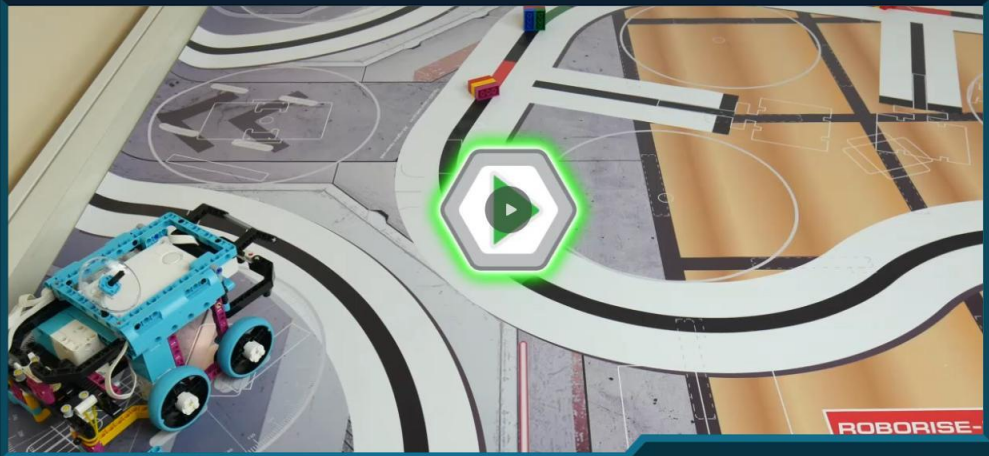
Algorithm | Program

The test program may look like this:



Task 11

Write a program in which the robot leaves the base, picks up one small and one large piece of debris, and returns to the base after detecting the fourth green zone on the trajectory



Task 11. Program 1

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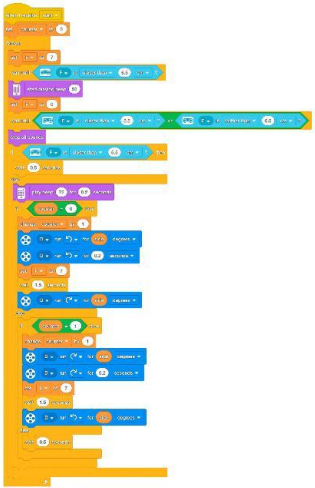
Algorithm | Program

The updated program may look like this:

Task 11. Program 2

Algorithm | Program

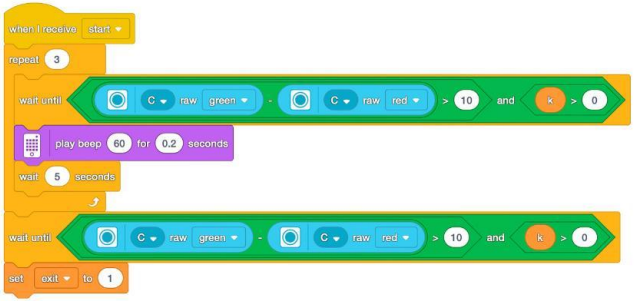
The updated program may look like this:



Task 11. Program 3

Algorithm | Program

The updated program may look like this:



Discuss!

- What event happened near your base on Mars?
- How do meteorites differ from asteroids and meteors?
- What types of meteorites do you know?
- What celestial bodies have you observed yourself?
- How did your robot distinguish the size of meteorites?
- What sensor is used to program the movement of the robot along the line?

Your achievements

Total: 0

1

2

3

4