photon

INTERACTIONS WITH ROBOT

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INTERACTIONS WITH THE ROBOT 4.1.1

Introduction

author: Sebastian Pontus

1. Introduce the new terms to the class.

2. Explain the terms and make sure that the children understand the importance of the newly learned words.

NEW TERMS

sensor – an element that detects signals and reacts to them

detector - another word for sensor

sensor readout - information received by the sensor

3. Explain to the class what interaction means for the robot:

Interaction for the robot is its behavior within an environment or setting. The robot collects data from the environment using its sensors and with this data the robot can react the way we program it to.

The human body also interacts with the environment by means of sensors. Our sensors are our senses (sight, hearing, smell, taste, touch). Thanks to them, we know how to react to various situations.

The most popular sensors are the proximity sensor, touch sensor, light sensor, color sensor and sound sensor.

Proximity sensor - an ultrasonic sensor. It sends a sound wave (with a frequency that humans cannot hear), which bounces off the object and returns to the robot. The sensor measures the reflection time of this wave and from this knows how far away the object is. Such „sensors" are used in nature, for example, by bats. Thanks to these sensors, they can „see" obstacles in the dark.

Touch sensor - a sensor that reacts to a direct physical stimulus (touch). It has two states: 0 and 1. 0 stands for no and means the sensor does not detect a touch. 1 stands for yes and means the sensor detects a touch.

Light sensor - the light sensor measures the intensity of white light. It also has two states, 0 and 1. If there is no or low intensity light, the state is 0, which is off. If there is high intensity light, the state is 1, or on.
Color sensor - this sensor sends (shines) a beam of light of a specific intensity and then measures how much light is sent back to the sensor. White and light colors reflect a lot of light, so much of it returns to the sensor. Black and dark colors absorb much of the light so significantly less returns to the sensor. Based on how much light returns to the sensor, the status is either 0 (dark) or 1 (bright).

Sound sensor - the sound sensor measures the intensity of a sound wave (its volume). If there is no detection of sound (silence) the state of this sensor is 0. If the sensor hears a sound, the state of the sensor will be 1.

4. Have your students design a "sensor game" based on human senses and their reactions. For example for touch they could make the rule that "when you touch my hand, I will say cheese." For hearing, you could make the rule that "when you say apple, I will take a step back." Have them write their sensor rules on a piece of paper. Then pair the students up and have them take turns testing each others' sensors.

INTERACTIONS WITH THE ROBOT 4.2.1

Offline task

author: Sebastian Pontus

Activity 1. Follow the line

1. Ask for a volunteer who would like to become a robot for 5 minutes.

2. Ask the child to stand in the middle of the room (a empty space is needed) and blindfold her/him. The child's task is to listen to and follow your commands.

step - means 1 step ahead,
left - means turn to the left,
right - means turn to the right.

Instructions for the child to perform:

step, step, left, step, step, left, step, step, right, step, step, right

3. Ask the students how this is like a robot with a sensor. Together, design a route using, for example, a rope, shoes, school items etc. The route should be marked with two boundaries - right and left.

4. Pair up the children.

5. Student A stands at the beginning of the route and is blindfolded. Ahe/he will only move with the aid of a sound sensor - hearing.

Student B issues commands for student A, as in the previous task, so that student A can reach the end of the route.

6. The goal is to reach the end of the route as soon as possible. Each step taken outside the designated route means 1 second added to the final time.

INTERACTIONS WITH THE ROBOT 4.2.2

Offline task

author: Sebastian Pontus

Activity 1. At what distance?

1. Prepare the necessary materials:
- One or two dice (for each pair) of students. A single mathematical die works well (range 1-10 or other). Each dot on the die is a multiple of the specified distance (eg 10 cm, 20 cm, 15 cm - a great way to repeat the multiplication table),
- Measuring tape (it can be made of paper, eg bought in a home improvement store),
- An object for determining distance (eg a stuffed animal).

2. Divide students into pairs. Each pair should receive a die.

3. The goal of the game is for students to estimate distances and understand the statement "if closer than/ if farther than."

4. Student A throws a die. Then, from a set point, he estimates the distance rolled on the die. For if he has rolled a 4 and each dot is 10 cm, he will estimate a distance of 40 cm from the set point.

5. Student B then guesses if the distance estimated by Student A is closer than or further than the rolled distance (40 cm).

6. Student A measures the real distance with a ruler. If the statement of student B is correct. Student B scores a point and rolls the die. If she incorrect then once again student A rolls the die. The winner is the student who is the first to score 10 points.

Example:

It is determined that: 1 dot - 10 cm.

Student A rolls a 5: 5 x 10 cm = 50 cm. He/she estimates a distance of 50 cm starting from a fixed place.

Student B claims that the estimated distance is more than 50 cm from the set point.

Student A checks the distance using a ruler and compares the correct measurement with his/her estimation. Then she/he compares the provided distance with student B's guess.

The distance estimated by Student A was 59 cm so Student B was correct.

Student B wins the point and throws the die.

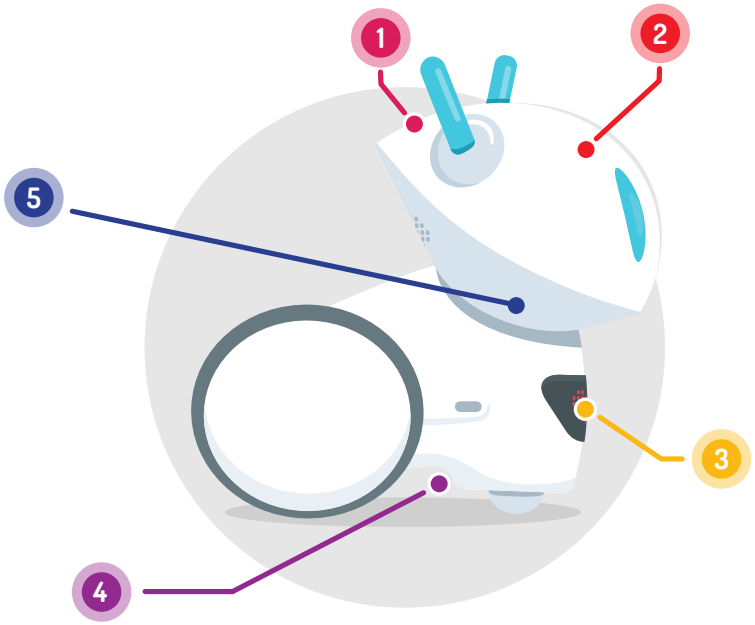
INTERACTIONS WITH THE ROBOT 4.3.1BA

Introduction to programming **Photon Badge**

Access code:

Author: Zuzanna Olechno

1. While showing the robot to the children, indicate where the sensors are located and tell them how they work.



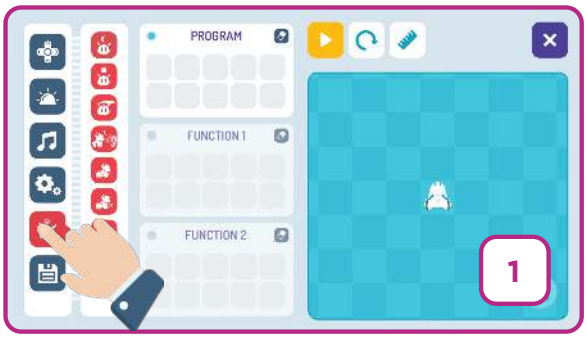
1. Light sensor - the robot recognizes whether the room is bright or dark.
2. The touch sensor - the robot will react when we pat it on the forehead.
3. Distance sensor - the robot can determine the distance from an obstacle. The sensor has a range of 100 cm.
4. Ground contrast sensor - the robot is able to find a path glued or drawn with a black marker on a white surface and follow it.
5. Sound sensor - the robot is able to react to a loud sound, eg clap.

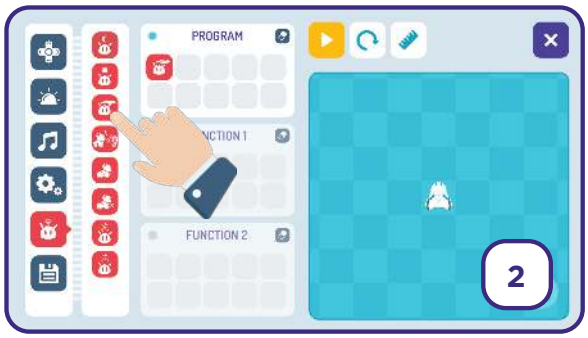
2. Turn on Photon and open the Photon Edu app. If you are able to, share the tablet screen on the projector so that all students can see exactly what is happening on the tablet screen.

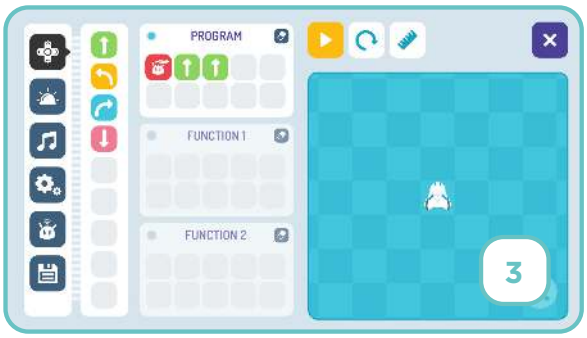
3. Once connected to the robot, use the access code to run the Photon Badge interface .

4. Show your students how to use sensors in the application.

To use the sensors in the applications:
[1] go into category interactions,
[2] select the sensor you would like to use,
[3] add a command for the robot to follow after receiving the signal.








sensor: wait for light


sensor: wait for dark


sensor: wait for touch


sensor: wait for noise


sensor: wait for an obstacle


sensor: wait for an lack of obstacle

wait for 5 seconds

wait for 2 seconds

5. Investigating the sensors: Divide your students: into 4 groups. The task of each group will be to test each sensor and examine its capabilities and limitations.

6. Give your students worksheets to write their observations on.

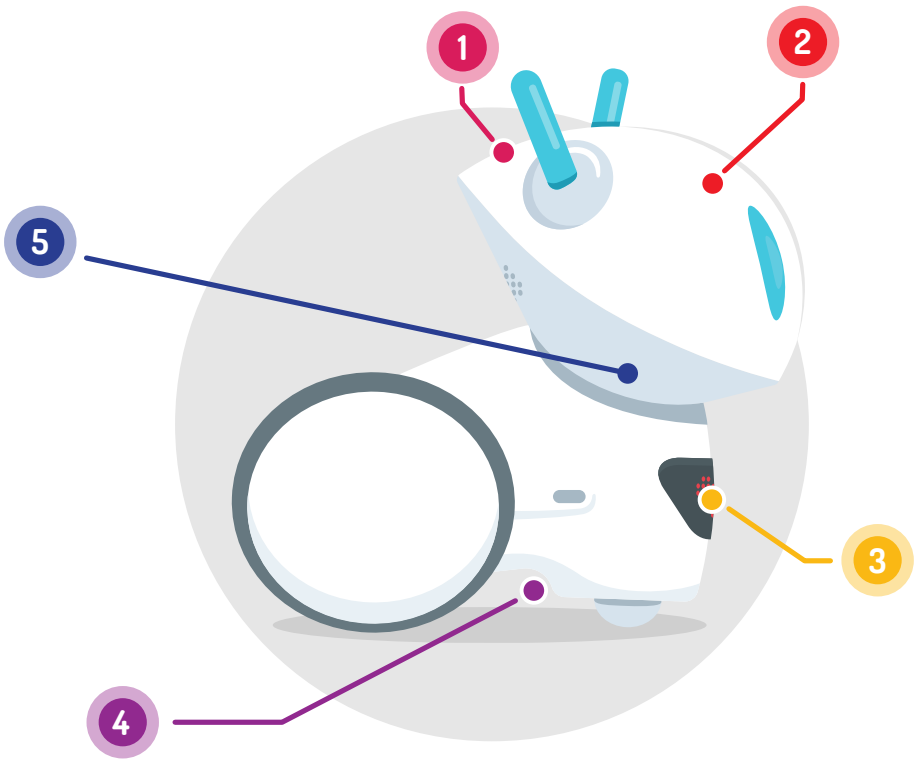
7. When the groups are done exploring the sensors, have them compare what they discovered.

WORKSHEET

name: _____ class: _____

Activity 1 Investigate each of the robot's sensors. Write down its possibilities, what it can be used for and what limitations it has.

Write down which sensors the robot has and where they are located:



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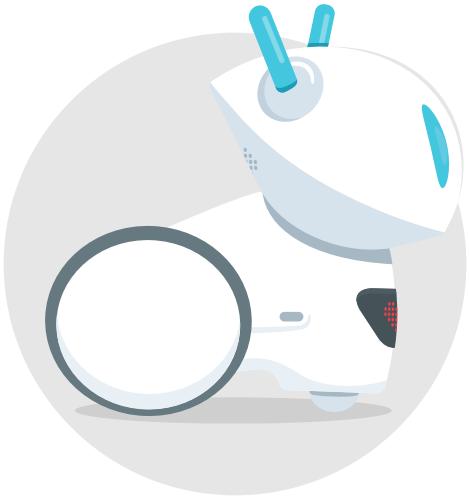
1. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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2. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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3. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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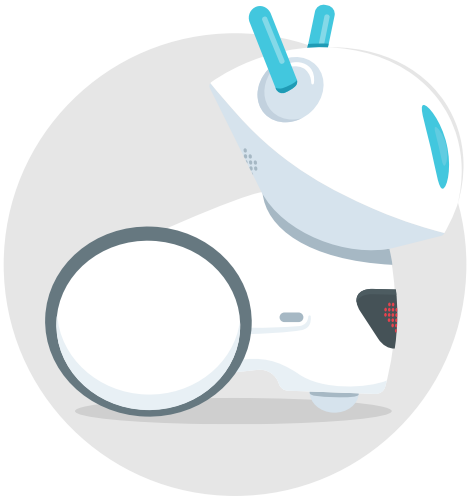
4. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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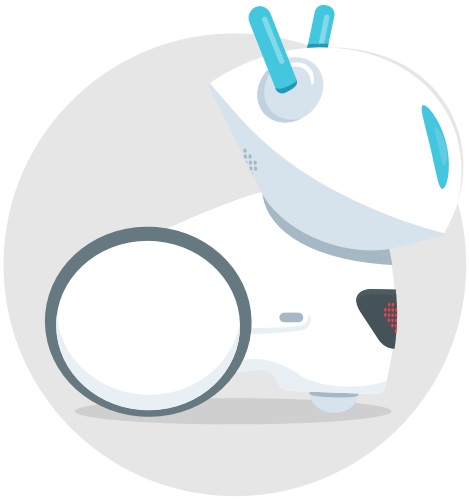
5. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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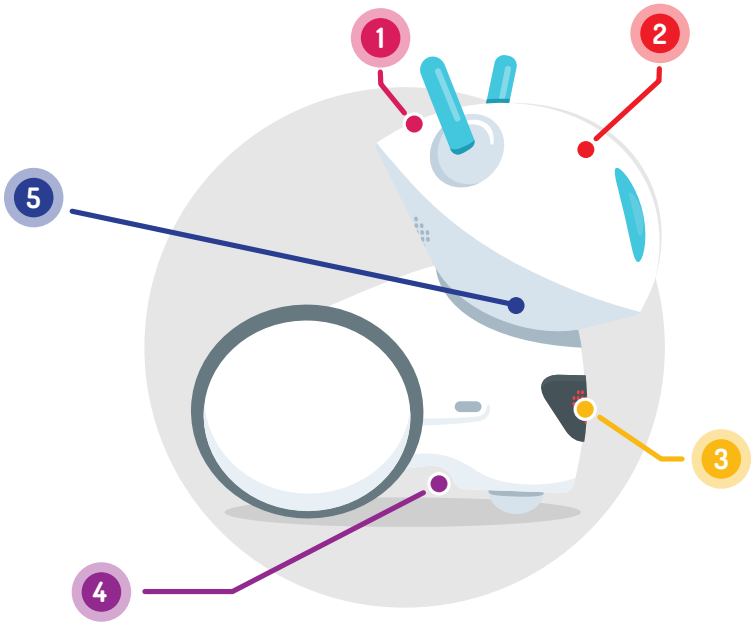
INTERACTIONS WITH THE ROBOT 4.3.1BL

Introduction to programming **Photon Blocks**

Access code:

author: Zuzanna Olechno

1. While showing the robot to the your students, indicate where the sensors are located and tell them how they work.



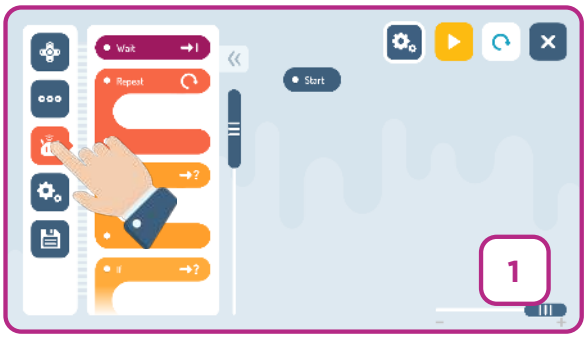
1. Light sensor - the robot recognizes whether the room is bright or dark.
2. The touch sensor - the robot will react when we pat it on the forehead.
3. Distance sensor - the robot can determine the distance from an obstacle. The sensor has a range of 100 cm.
4. Ground contrast sensor - the robot is able to find a path glued or drawn with a black marker on a white surface and follow it.
5. Sound sensor - the robot is able to react to a loud sound, eg clap.

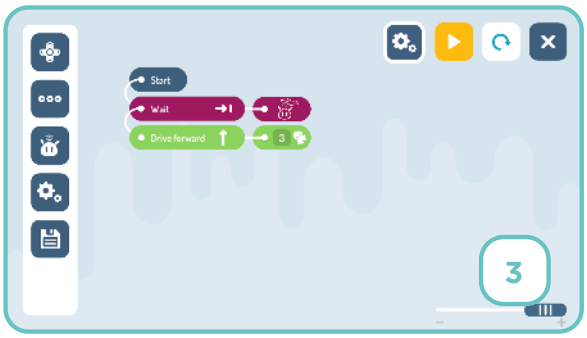
2. Turn on Photon and open the Photon Edu app. If you are able to, share the tablet screen on the projector so that all students can see exactly what is happening on the tablet screen.

3. Once connected to the robot, use the access code to run the Photon Blocks interface .

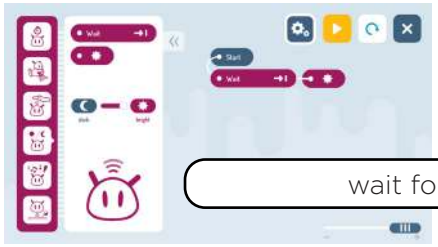
4. Show your students how to use sensors in the application.

To use the sensors in the applications:
[1] go into category interactions and add block „wait” to the program,
[2] select the sensor you would like to use,
[3] add a command for the robot to follow after receiving the signal.



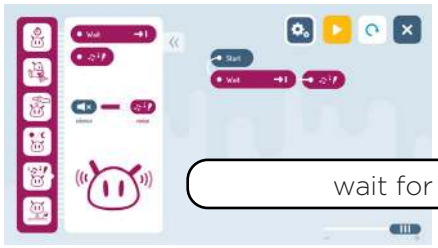


wait a certain amount of time

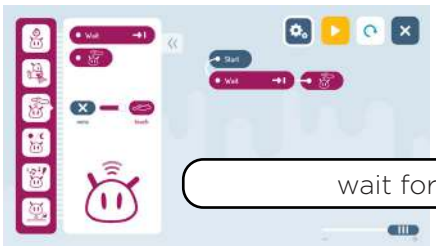


wait for light

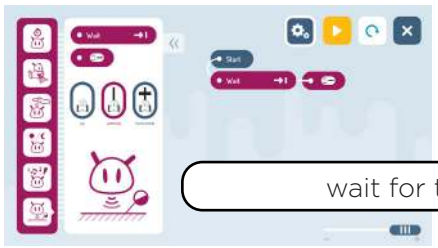
wait for an obstacle



wait for a noise



wait for touch



wait for the line

5. Investigating the sensors: Divide your students: into 4 groups. The task of each group will be to test each sensor and examine its capabilities and limitations.

6. Give your students worksheets to write their observations on.

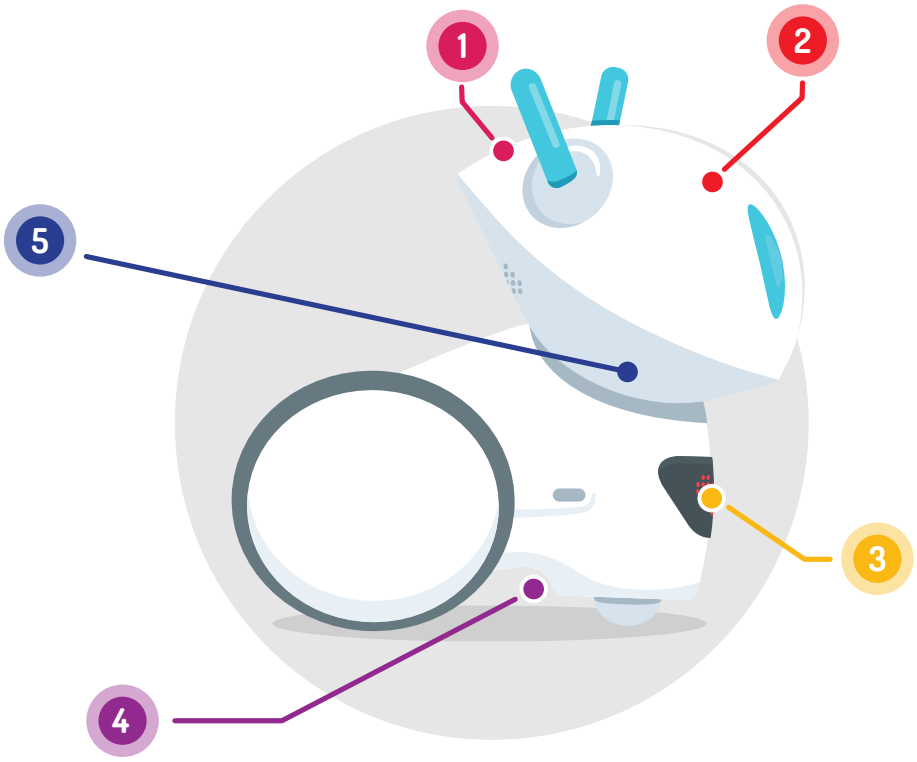
7. When the groups are done exploring the sensors, have them compare what they discovered.

WORKSHEET

name: _____ class: _____

Activity 1 Investigate each of the robot's sensors. Write down its possibilities, what it can be used for and what limitations it has.

Write down which sensors the robot has and where they are located:



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1. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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2. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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3. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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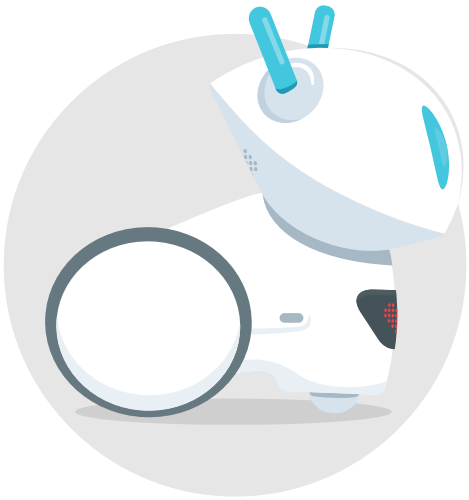
4. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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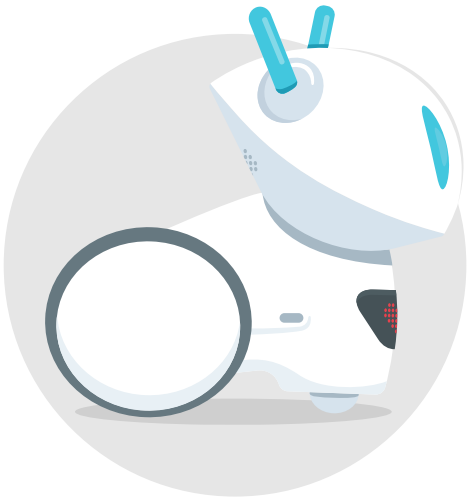
5. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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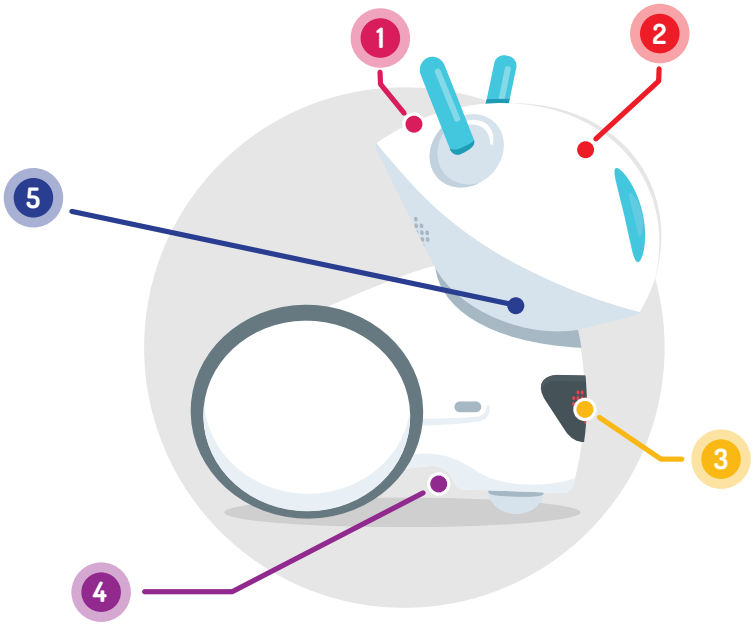
INTERACTIONS WITH THE ROBOT 4.3.1CO

Introduction to programming **Photon Code**

Access code:

author: Zuzanna Olechno

1. While showing the robot to your students, indicate where the sensors are located and tell them how they work.



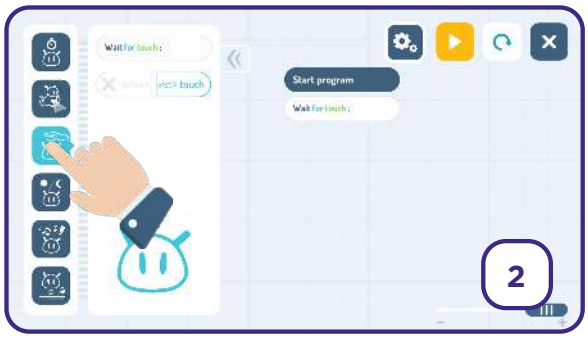
1. Light sensor - the robot recognizes whether the room is bright or dark.
2. The touch sensor - the robot will react when we pat it on the forehead.
3. Distance sensor - the robot can determine the distance from an obstacle. The sensor has a range of 100 cm.
4. Ground contrast sensor - the robot is able to find a path glued or drawn with a black marker on a white surface and follow it.
5. Sound sensor - the robot is able to react to a loud sound, eg clap.

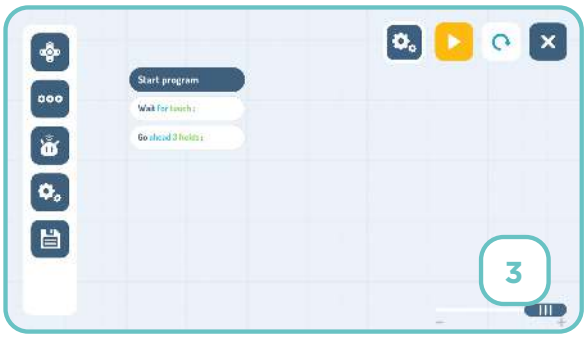
2. Turn on Photon and open the Photon Edu app. If you are able to, share the tablet screen on the projector so that all students can see exactly what is happening on the tablet screen.

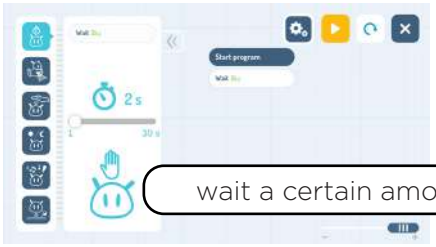
3. Once connected to the robot, use the access code to run the Photon Code interface .

4. Show your students how to use sensors in the application.

To use the sensors in the applications:
[1] go into category interactions and add block „wait” to the program,
[2] select the sensor you would like to use,
[3] add a command for the robot to follow after receiving the signal.

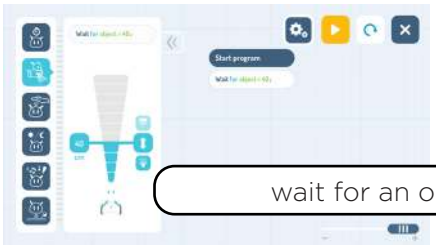




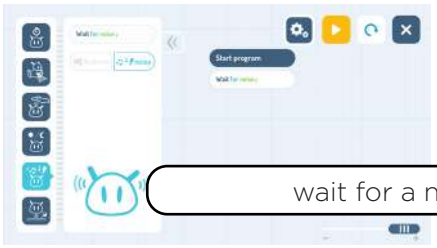


wait a certain amount of time

wait for light

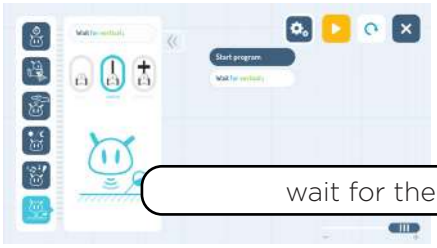


wait for an obstacle



wait for a noise

wait for touch



wait for the line

5. Investigating the sensors: Divide your students: into 4 groups. The task of each group will be to test each sensor and examine its capabilities and limitations.

6. Give your students worksheets to write their observations on.

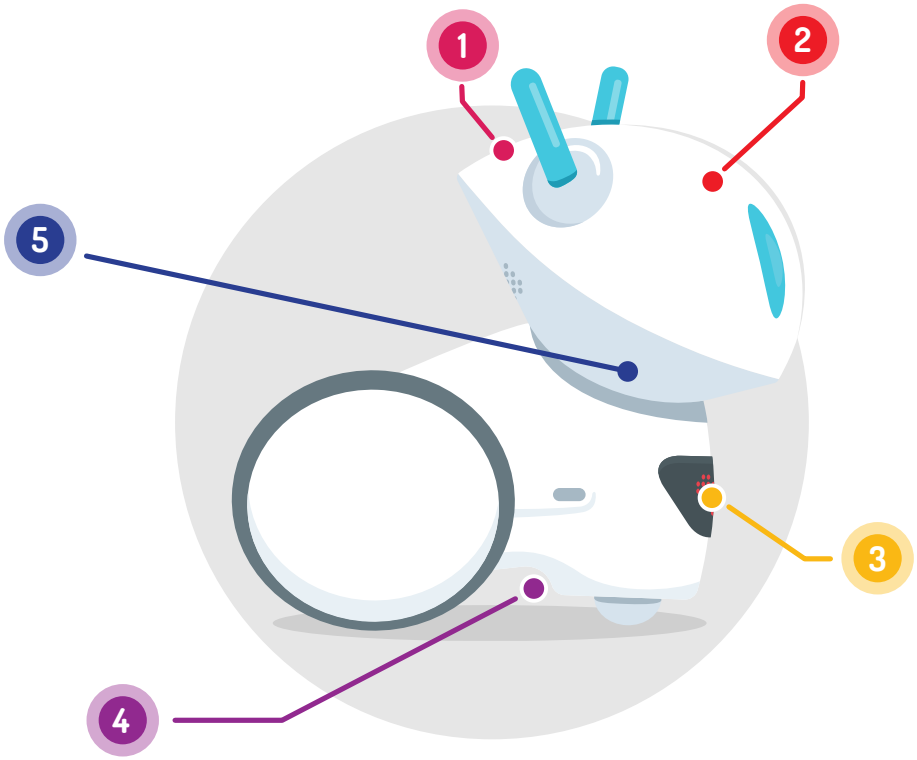
7. When the groups are done exploring the sensors, have them compare what they discovered.

WORKSHEET

name: _____ class: _____

Activity 1 Investigate each of the sensors the robot has. Write down its possibilities, what it can be used for and what limitations it has.

Write down which sensors the robot has and where they are located:



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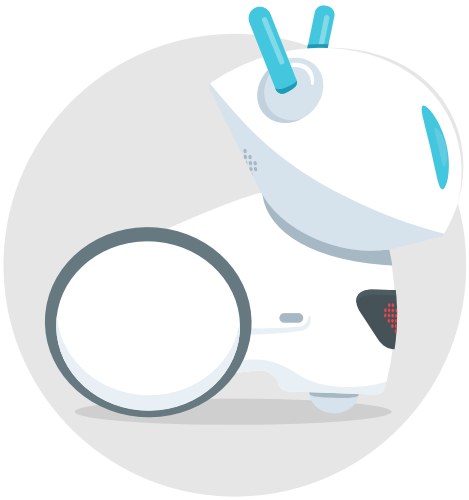
1. Tested sensor: .....

Mark its location:



What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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2. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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3. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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4. Tested sensor: .....

Mark its location:

What are its capabilities (how does it work?)

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What can it be used for?

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What are its limitations?

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5. Tested sensor: .....

Mark its location:

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What can it be used for?

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What are its limitations?

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INTERACTIONS WITH ROBOT 4.4.1BA

Activity **Photon Badge**

Access code:

author: Sebastian Pontus

1. Divide the students into groups of two. Give each team a Photon and a tablet with the Photon Edu application.

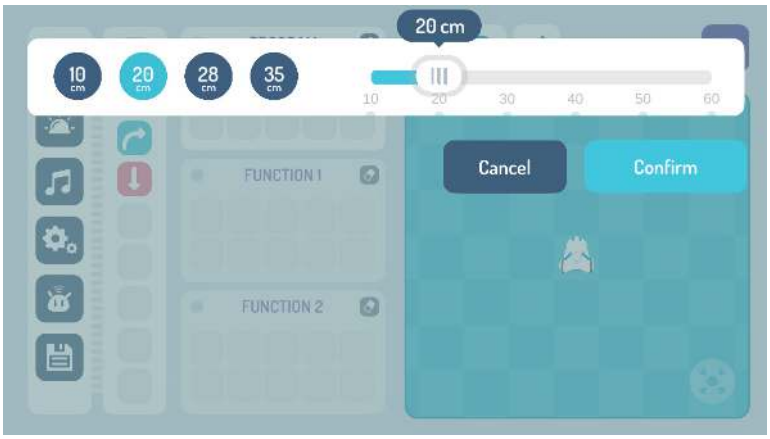
2. Challenge: Photon loves to participate in competitions, but it happens to be lazy and we need to pet it in order to motivate it. Write a program, where the robot will move 20 cm forward each time you pet it Photon will need to cover a two meter route.

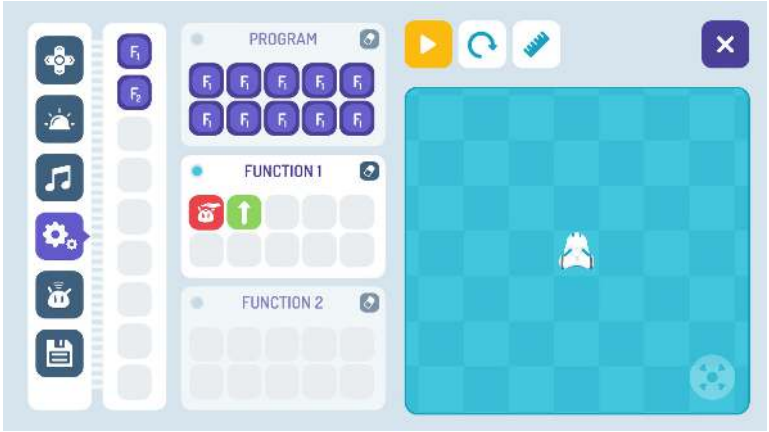
3. Together, lay out a route that is 2 meters long. Mark “start” and “finish.”

4. Each team will need to set their robot on the start line and create a program to get Photon to the finish.

5. One student from each team will start their program at the signal. From the team starts the program at the signal. The second student in the pair will motivate Photon to move by pating it.

6. The team whose robot is the first to reach the finish line wins.





INTERACTIONS WITH ROBOT 4.4.1BL

Activity **Photon Blocks**

Access code: 

author: Sebastian Pontus

1. Divide your students into teams of two. Give each team a Photon and a tablet with the Photon Edu application.

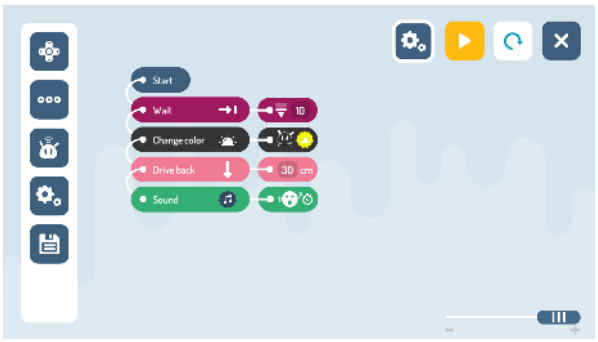
2. Print and cut out the cards with tasks (provided below).

3. Give each pair one card with a task to be solved.

4. There are two tasks: **Photon revolves with joy** and **Photon is careful.**

Photon revolves with joy
Program the robot in such a way that when you spat it, it will turn left out of joy, then turn to the right and shout for joy.

Photon is careful
Program the robot in such a way that when we put an obstacle in front of it, its antennae light yellow, it backs up 30 centimeters and gives a shout of surprise.



5. Have the student pairs work on their task, using the worksheet to write down all of the steps.

6. After completing the task, check the solutions by running the robots. Compare programs with each other. Do all the solutions look the same?

Materials to be cut out: cut on the dotted line

Photon revolves with joy
Program the robot in such a way that when you spat it, it will turn left out of joy, then turn to the right and shout for joy.

Photon is careful
Program the robot in such a way that when we put an obstacle in front of it, its antennae light yellow, it backs up 30 centimeters and gives a shout of surprise.

Photon revolves with joy
Program the robot in such a way that when you spat it, it will turn left out of joy, then turn to the right and shout for joy.

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Program the robot in such a way that when we put an obstacle in front of it, its antennae light yellow, it backs up 30 centimeters and gives a shout of surprise.

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Program the robot in such a way that when we put an obstacle in front of it, its antennae light yellow, it backs up 30 centimeters and gives a shout of surprise.

Photon revolves with joy
Program the robot in such a way that when you spat it, it will turn left out of joy, then turn to the right and shout for joy.

Photon is careful
Program the robot in such a way that when we put an obstacle in front of it, its antennae light yellow, it backs up 30 centimeters and gives a shout of surprise.

WORKSHEET

name: _____ class: _____

Activity 1.

Plan what the robot should do.

Is there only one solution to this task? If not, think which solution would be the shortest?

Did the robot do what you planned after starting the program?

If any problems arose, write down what caused them.

INTERACTIONS WITH ROBOT 4.4.1CO

Activity **Photon Code**

Access code:

author: Sebastian Pontus

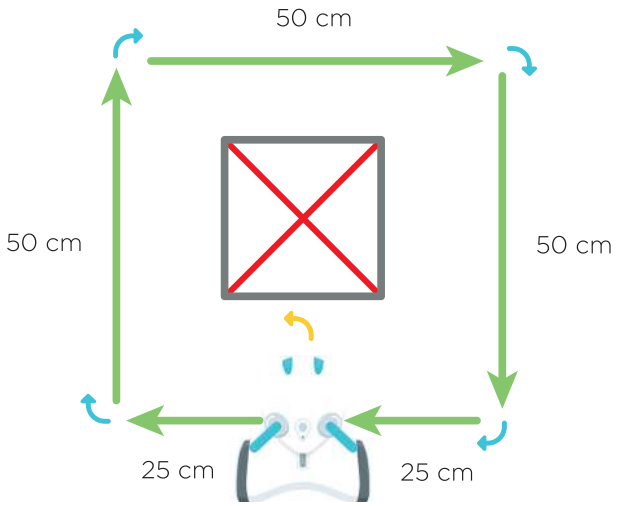
1. Divide the students into teams of two. Give each team a Photon and a tablet with the Photon Edu application.

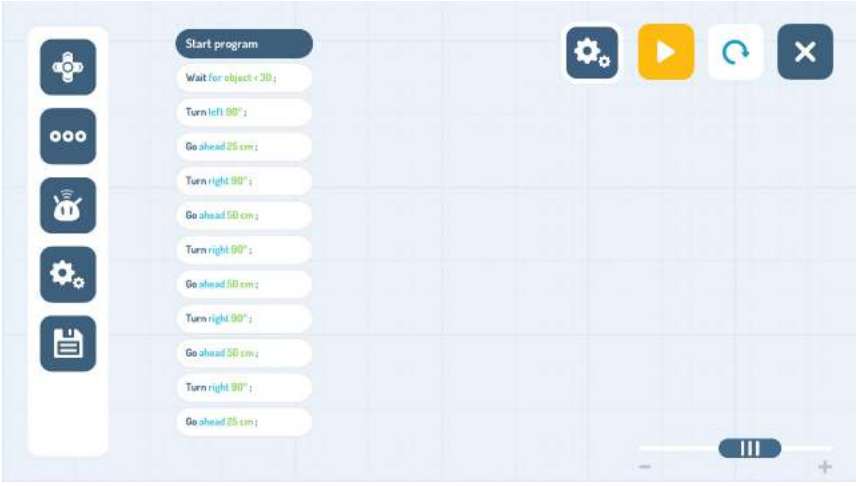
2. Print and cut out the cards with tasks (found below).

3. Give each pair one card with the task to be solved.

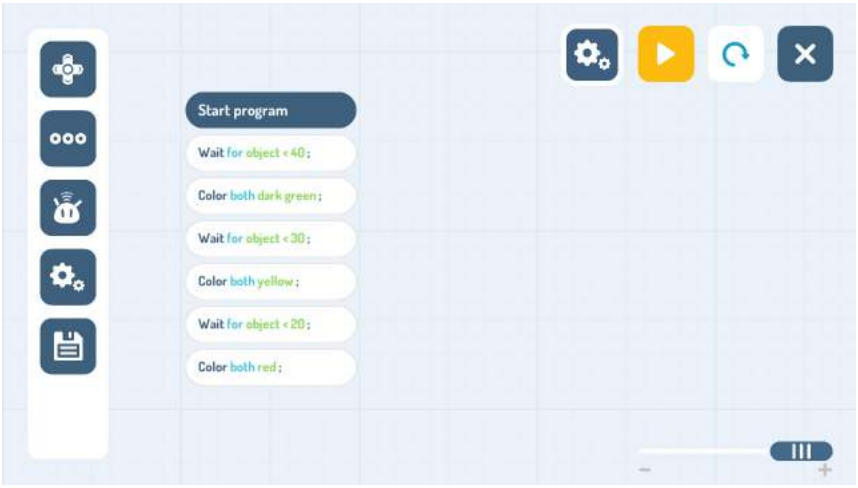
4. There are two tasks: Curious Photon and Photon radar.

Curious Photon
Program the robot in such a way that when we place an obstacle in front of it at a distance of 30 cm, it goes around the object, making sounds of admiration and then returns to the starting place. Remember to check the obstacle's circumference or perimeter.





Photon radar
Program the robot so that when it detects an object at a set distance, it does the following:
- Object 40 cm away, Photon's antenna glow green
- Object 30 cm away, Photon's antenna glow yellow
- Object less than 20 cm away, Photon begins to get nervous and its antenna glow red



5. Children perform tasks in pairs using the worksheet and writing down all steps.

6. After completing the tasks, jointly check the solutions by running robots. Compare programs with each other. Do all the solutions look the same?

Materials to be cut out: cut on the dotted line

Curious Photon
Program the robot in such a way that when we place an obstacle in front of it at a distance of 30 cm, it goes around the object, making sounds of admiration and then returns to the starting place. Remember to check the obstacle's circumference or perimeter.

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WORKSHEET

name: _____ class: _____

Activity 1.

Plan what the robot should do.

Is there only one solution to this task? If not, think which solution would be the shortest?

Did the robot do what you planned after starting the program?

If any problems arose, write down what caused them.

INTERACTIONS WITH ROBOT 4.5.1

Summary

Extension Activity:

1. Explain to your students what a Rube Goldberg machine is.

2. Have your students form groups of 5 (or assign them to groups) to plan their own Rube Goldberg machine. The idea is for them to design a machine that is based on sensors (they will not need to build it, but will write out a plan for it) For example,
- To start the machine, press the red button that will release the ball that will roll on the track.
- When the ball hits the bobbin at the end of the track, the sound sensor next to it will turn on the water tap.
- etc.

3. Allow students to use their imagination to design any type of sensor-based machine they want; it can be simple or it can be very complicated with a lot of sensors.

4. After they have come up with a plan, have your students draw what they machine would look like.