Photon

The Robotics and Coding **Kit**

Get to know your teaching kit

Congratulations

on choosing the *Photon Robotics and Coding Kit*.

This kit aims to introduce children to the basics of programming using the Photon Robot connected to a microcontroller. The included resources are divided into 16 lesson scenarios that introduce complex coding issues in stages – from basic programs to projects requiring to rely on sensor readings. One of the key elements of the lesson scenarios is combining the capabilities of the Photon Robot with the micro:bit microcontroller. Thanks to such a comprehensive kit and its features, students can learn programming in a variety of new and advanced ways.

The Photon Robotics and Coding Kit allows students to learn new practical skills, technology flexibility, new programming languages, and hardware solutions sought-after by employers and the future job market.

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Get to know your teaching kit

The Robotics and Coding Kit has been designed for computer science teachers who conduct classes for children aged 12 years and older. The kit aims to support them in teaching programming using modern educational methods. Students are given the opportunity to participate in inspiring projects and explore the possibilities of combining the Photon Robot with the micro:bit microcontroller, such as, designing a vehicle with a reverse sensor. We hope that completing tasks in this kit will encourage as many students as possible to further develop their advanced technological competence.

Teaching resources background

The projects available in this kit are arranged in a sequence that allows students to gradually learn how to program. However, you are free to use the lesson scenarios in any order, as each lesson is a separate topic and project. All necessary resources and information are available in an electronic form (PDF files) in the Photon Magic Bridge application that is an integral part of the *Robotics and Coding* kit.

UNDERSTANDING TECHNOLOGY

GROUP WORK

CREATIVITY

CODING

The kit contents

The **Photon Robot** (2 pcs) – Your learning companion and the main tool in robotics projects. You will be in control of the Photon Robot, changing its configuration and behavior in order to carry out inspiring projects. A color-coded weather station, a light dimmer, a vehicle with a reversing sensor – these are just examples of what you can do by working with this kit. You can test many advanced functions, such as motion and temperature sensors, radio communication, and learning commands responsible for sound and color changes, by interacting with the BBC micro:bit microcontroller.

Photon Magic Dongle (2 pcs) – A small USB adapter that allows the robot to connect wirelessly to a computer using the Photon Magic Bridge application.

BBC micro:bit v2 (2 pcs) – A microcontroller, which allows to expand robot's capabilities thanks to a built-in accelerometer, magnetometer, 5x5 LED display, Bluetooth 5.0 support and other features. Each unit comes with a USB-A – micro-USB communication cable for computers, a battery box with a dedicated power cord, two AAA batteries and an instruction manual.

BBC micro:bit v2 holder (2 pcs) – Allows the microcontroller to be attached to the robot's ears to greatly facilitate the use of the two connected devices.

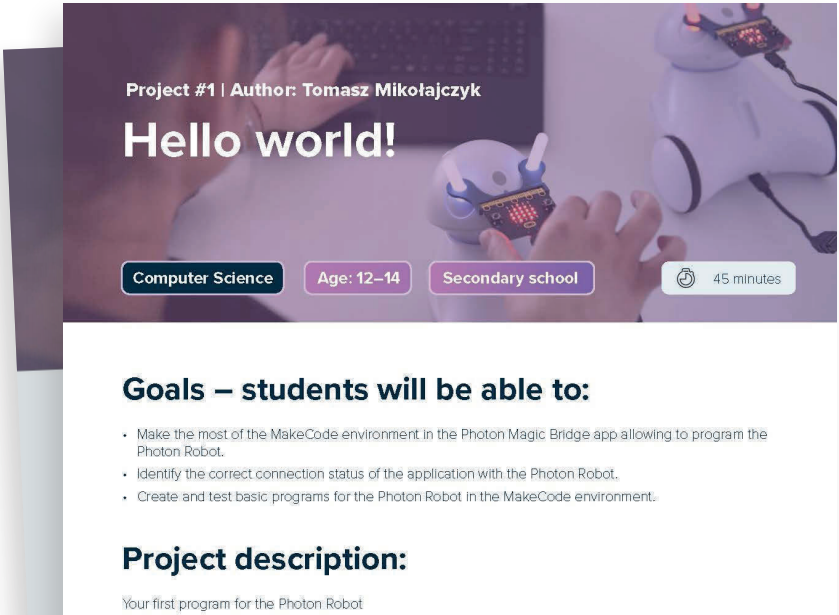
Set of cables (4 pcs) – A set of USB cables; one charging cable for the Photon Robot (USB-A – micro-USB) and one to connect the robot to the BBC micro:bit microcontroller (micro-USB – micro-USB OTG).

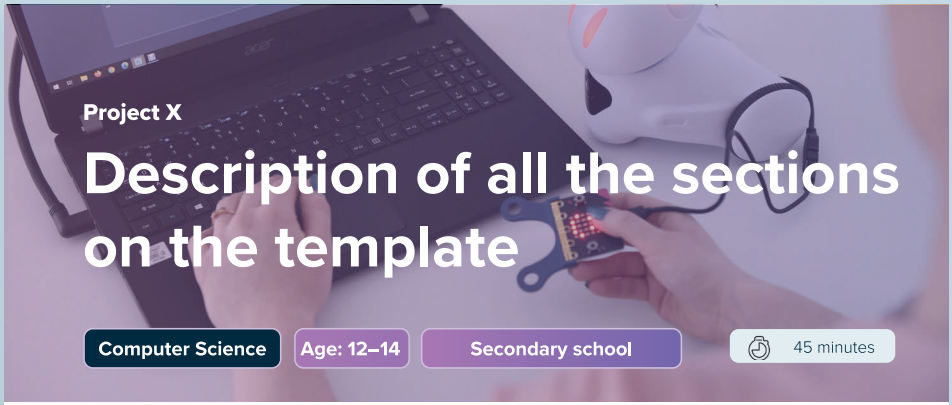
Projects for students

The Robotics and Coding Kit includes lesson scenarios for 16 projects that involve creating separate program logic for the Photon Robot and the BBC micro:bit microcontroller. Each project in the *Robotics and Coding* kit (accessible from the Photon Magic Bridge app) has two types of resources – **lesson scenarios** and an **introduction** to the activity. Please note that the lesson scenarios can only be accessed from the Teacher Account.

The kit is a set of 16 ready-to-use computer science lesson scenarios for children aged 11–14 and older. The following sections are included in each scenario: *Objectives*, *Project description*, *Required items*, *Ready programs*, *Introduction,* and *Learning activity*. All the additional information allow to easily match the right activity to your students' level.

You can start your adventure with the Photon Robot by completing any project you choose first, as each project can be customized to fit your teaching plan. The exceptions are scenarios 1–3 (*Hello World; Micro:bit – technology miniaturization; Together we can achieve more*), which serve the purpose of an introduction to the application and the kit. For this reason, we suggest that you start your work with the *Robotics and Coding* kit with the three scenarios listed above.





Project X

Description of all the sections on the template

Computer Science | Age: 12–14 | Secondary school | 45 minutes

Goals – students will be able to:

In this section you see a list of the main class goals. Here you can find a description of the key competencies that students will develop during the activity.

Project description:

Description of the expected result of a properly executed project. For example, it could be a self-driving vehicle with a reverse sensor, a timer for counting down tea brewing time, or an alarm system.

Required items:

A list of teaching aids and accessories required to complete the project.

Ready Programs:

A list of ready-made programs that come with the Robotics and Coding Kit in the Photon Magic Bridge application – available in the Teacher Account. These programs with sample solutions to the project, come in two versions – for the Photon Robot itself and for the BBC micro:bit microcontroller.

Introduction:

A brief description explaining how you can introduce students to the topic of a given project. It could be a topic for a talk, a demonstration of the Photon Robot's functions, a reminder of a previously discussed topic, or any other hint or brief adapted to the specifics of the class.

Learning activity:

Discussion of the further course of the project, including the type of activity, project goals, and other relevant information. In addition, at the end of this section you can find tips on how to conduct the class and how to follow it up in a future project.

Photon Magic Bridge app

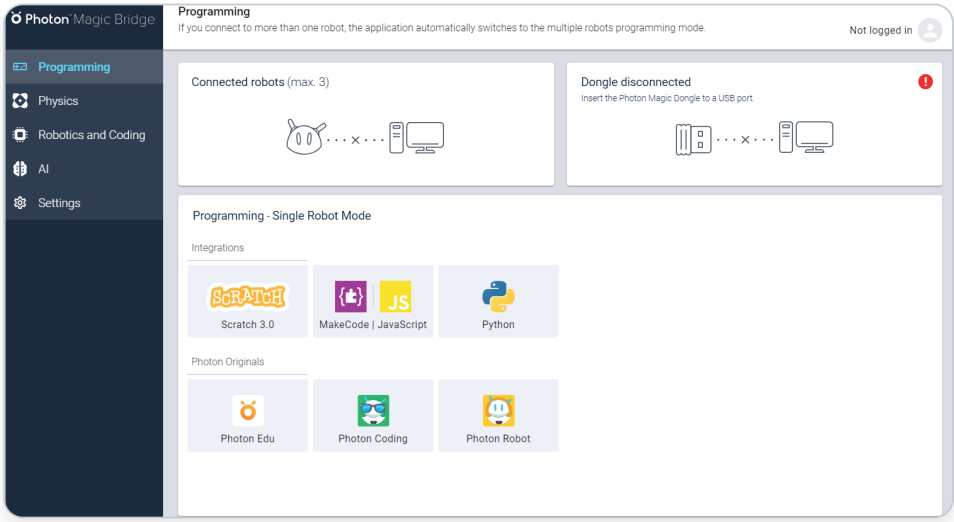
The Photon Magic Bridge is an application for desktop computers that opens up a whole new way of working with the most popular coding learning tools, such as MakeCode. The application is divided into four modules: *Programming*, *Physics*, *Artificial Intelligence* and *Robotics and Coding* – used while working with this kit.

Launching the Photon Magic Bridge app

Please download the Photon Magic Bridge app from our website:

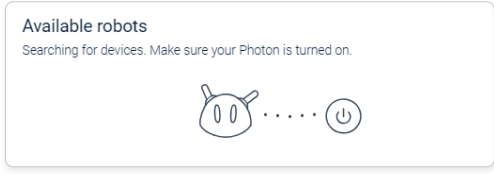
https://photon.education/magic-bridge-download

If you are using Windows or macOS computers, you can download the app to your device and use it even without Internet access. On the other hand, for ChromeOS computers, the application will run in the browser, so Internet access is required at all times.

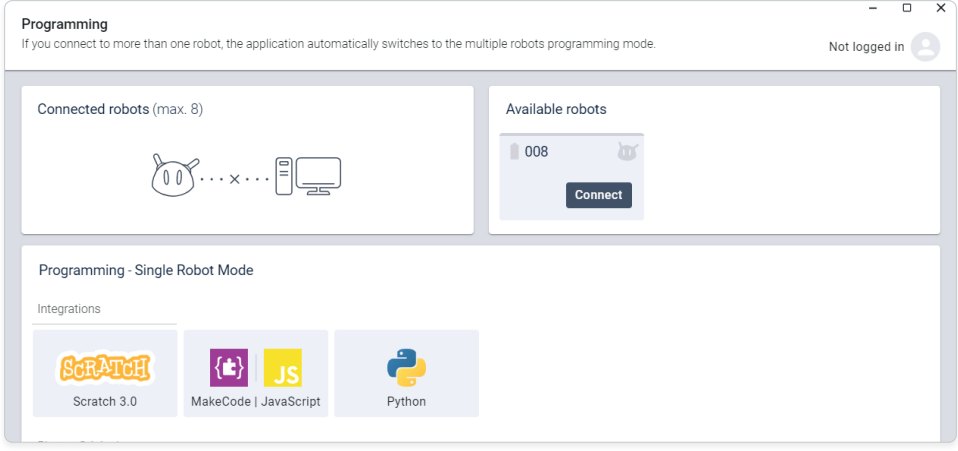


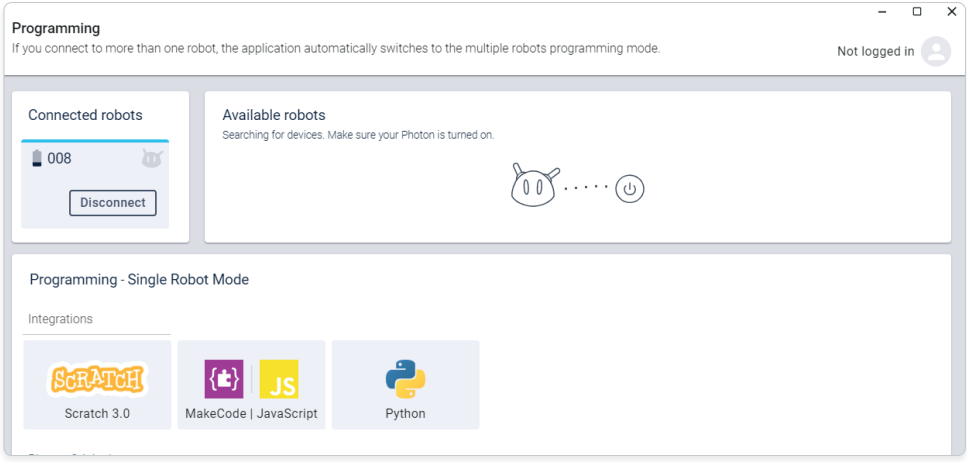
How to connect to the Photon Robot

First of all, insert the Photon Magic Dongle into your device, as only this USB dongle allows you to connect your computer to the robot.



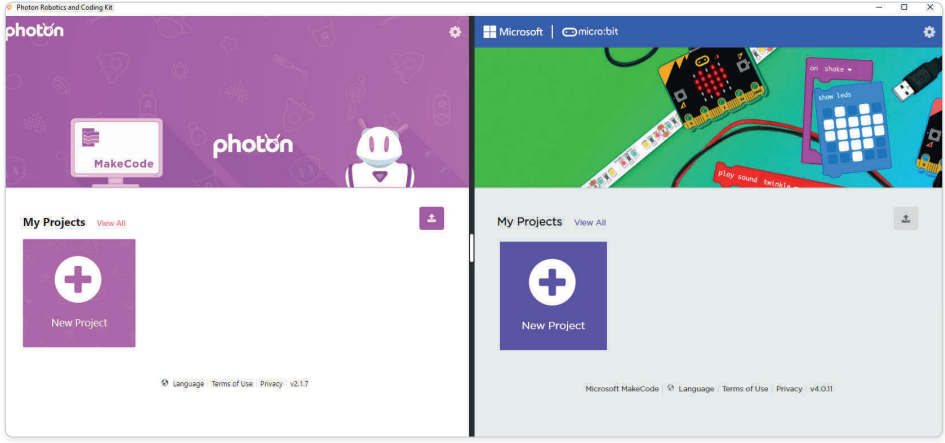
After launching the Photon Magic Bridge app, you will see a section with information about the number of robots connected to the application (on the left side of the window) and whether the Magic Dongle is connected to your computer's USB port (on the right side). Then turn on at least one Photon Robot and wait for the app to show it on the list of available robots. Then, click the Connectbutton. Upon successful connection to the robot, the app will display the name of the robot paired with the app on the left, as well as an icon representing the battery state of charge.





How to get started with the *Robotics and Coding Kit*

The Robotics and Coding Kit allows students to program both the Photon Robot and the BBC micro:bit microcontroller. To begin, open the Photon Magic Bridge application and select the Robotics and Coding Kit icon from the menu on the left. Then, choose your account type (if you are using the Teacher Account, please log in beforehand). After activating the Teacher Account or Student Account, you can launch the Kit's application. For convenience, the interfaces of the Photon Robot and the BBC micro:bit controller are displayed next to each other on the split screen of the Photon Magic Bridge app.

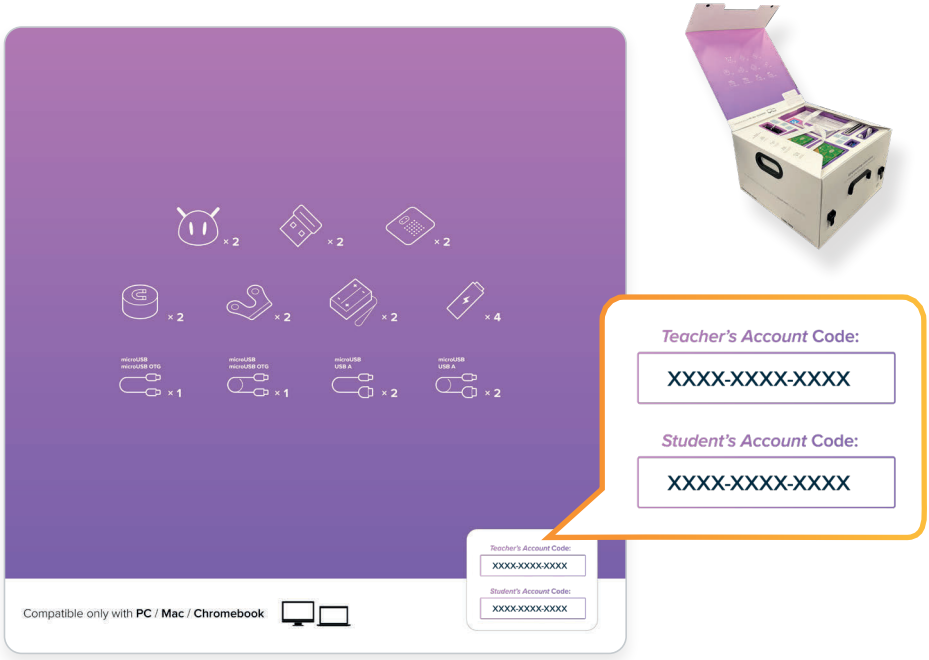


Activating Teacher and Student Accounts

There are two types of accounts – for **Teachers** and **Students**. Each gives access to the programming application. The key difference is that the Teacher's account gives access to the necessary teaching resources and sample project solutions.

You can activate both types of accounts on an unlimited number of desktop computers by entering unique codes included in the kit. Activation codes for each account are on stickers on the inside of the kit box.

Looking for your activation codes?
You can find them right here on the inside of the kit packaging.



More inspirations

Please keep in mind that we have only covered a subset of our robot's capabilities in this guide. We encourage you to further explore its potential together with your students in many other educational activities – we are sure children will love the Photon lessons!

Do you have questions?
Or are you looking for inspiration?
Use the links below to find new ideas and information:

If you have any questions, please visit our Help Center:

https://help.photon.education

Join our global community of educators:

Photon Global Community

For inspirations on how to use the Photon Robot in your classes visit:

https://portal.photon.education/en

No	Title	Project description
1	Hello world!	Your first program for the Photon Robot
2	Micro:bit – technology miniaturization	Your first program for the micro:bit:
3	Together we can achieve more!	The Photon Robot and the micro:bit communication interface
4	Obstacle detection	Motion sensor relying on the Photon Robot data transmission
5	Weather station	Weather station (monitor changes in temperature and signal them by changing Robot's ears color)
6	Photon Robot on a leash	Manipulator / remote control for the Photon Robot

Goals

Students will be able to:

- Make the most of the MakeCode environment in the Photon Magic Bridge app allowing to program the Photon Robot
- Identify the correct connection status of the application with the Photon Robot
- Create and test basic programs for the Photon Robot in the MakeCode environment

- Get familiar with the MakeCode environment in the Photon Magic Bridge application used to program the micro:bit device
- Create basic programs for the micro:bit device using the MakeCode interface
- Upload and test your first applications to the micro:bit device

- Create programs that combine capabilities of the Photon Robot and micro:bit
- Get familiar with the concept behind the serial transmission and its practical use (a communication between devices using a serial port)

- Use variables
- Practice mathematical operations on numbers and variables
- Program a device using a working principle of a well-known device

- Use *if...else* and *if* conditional statements
- Use gained knowledge in practice by designing a weather station

- Give examples of device manipulators
- Design and program a control device (manipulator/remote control)
- Learn using variables and loops in programming

No	Title	Project description
7	Dimmer	Light intensity controller (dimmer)
8	Remote commands	The Photon Robot wireless remote controller (using two micro:bits)
9	Welcome home! (IoT)	Multi-resident home activity recognition (using two micro:bits)
10	Magnetic field	Designing a device that sets the Photon Robot in motion after detecting a strong magnetic field deflection.
11	Backup light	Designing a self-driving vehicle with a parking sensor (use hazard warnings of your choice)
12	Tea time	A countdown timer for tea brewing (with audiovisual cues)

Goals

Students will be able to:

- Use the *if* condition
- Use the minimum and maximum permissible range of values for a variable
- Implement the RGB color model in practice

- Distinguish and implement wired and wireless communication
- Make informed decisions when selecting commands from the Movement section to achieve the desired project objective.

- Distinguish and implement wired and wireless communication
- Use wireless communication – radio-based (between micro:bits) and wired communication (between the robot and micro:bits)
- Program a “trusted resident” detection system

- Use the micro:bit's magnetic field sensor
- Calibrate the magnetic field sensor and interpret the readings
- Program the micro:bit device with a built-in magnetic field sensor to set the Photon Robot in motion after detecting a strong magnetic field deflection

- Give examples of self-driving robots
- Use programming loops, *if...else* conditions, variables, commands responsible for sound and the robot's LED light

- Use time as an operational variable in various devices
- Use commands responsible for time, variables, logical operators, functions, sounds, lights, and others

No	Title	Project description
13	Multi-sensor alarm	Designing an alarm component (or an entire alarm system)
14	Music score	Creating a prototype that allows to read black symbols off white surfaces and transcribing them into audio signals
15	RGB Lights	Color changing controller for the Photon Robot (based on readings from the built-in accelerometer)
16	Come over to the whiteboard	Programming the Photon Robot's audio response related to selecting an item from a list – using either an interactive whiteboard or projector.

Goals

Students will be able to:

- Identify the different types of alarms and their uses
- Use *if...else* conditions, variables, logical operators, sensors related commands, sounds, lights, etc.

- Interpret sensor readings
- Design new data entry interfaces for each device

- Learn the working principle of an accelerometer
- Implement advanced commands from the ***Text*** section (for micro:bit) to combine messages
- Use ***if...else*** conditions, variables, logical operators, join texts in communication

- Use whiteboards
- Understand the purpose and use digital devices in a classroom (other than computers)
- Design, develop, and test software that controls the Photon Robot, an on-screen object or a real-world object
- Manage variables efficiently (including variables zeroing)
- Present data in a user-friendly manner