EARLY Teaching Scenario

Topic: EV3 - parking, ultrasound and grippers

Learning outcome:

Familiarizing with the Lego MINDSTORM EV3 kit

Learning the basic characteristics of a robot

Learning how to program two types of motors and the ultrasonic sensor

Deepening the programming of the interaction between sensors and motors

Reasoning on issues such as sustainability, pollution, recycling and waste disposal

Skills pupils develop during the scenario (connect to curriculum →)**(with reference to "Learning, the treasure within", UNESCO, 1996 and "Defining and Selecting Key Competences", OCDE, 1999):**

- Thinking and learning to learn
- Taking care of others, managing daily activities, safety
- Multiliteracy
- Cultural competence, interaction and expression
- ICT competence
- Partecipation and influence in building a sustainable future
- Competence for the world of work, entrepreneurship

Target group: Middle school
Age of students: from 11 to 13 years old
Number of pupils: Maximum of 20
Duration (estimated time/number of lessons): 4x1h

Prerequisites (necessary materials and online resources):

- App LEGO MINDSTORM Education EV3
- LEGO MINDSTORM EV3 kit
- Free space on the floor
- Sheets of paper, pens and markers
- Coloured paper and cardboard
- Tablets or pc (one per kit)
- A carpet (see figure 2)
- Riley Rover Assembly Instructions http://www.damienkee.com/storage/rileyrover/RileyRover_BI.pdf
- ROBOESL Manual: http://roboesl.eu/wp-content/uploads/2017/08/O1_Cur01_final_03.pdf

Introduction to the scenario:

The Teaching Scenario includes a series of lessons that will lead students to build and program a real robot, using the Lego Mindstorm EV3 kit. Starting from their previous experience and knowledge on the subject, students will learn the correct definition of "robot" and "robotics"; at the same time they will work on the topic of environmental sustainability with particular reference to the problem of pollution and waste management. Gradually, students will learn how to build a machine able to move and how to use and program sensors and motors in order to be able to carry out a series of tasks that bring attention to the importance of recycling and correct waste disposal.

risks and possible applications:

- The scenario can be used as a starting point for a wider activity on the topic to be developed in the classroom.
- For the scenario teachers can use a different setting the carpet here proposed

Before the program begins (preparatory work for teacher):

- Charge tablets and PCs
- Divide the pupils into groups (3/4 pupils per group)
- Space

Main part of the scenario (no. of lessons): 4

- **lesson one:**

Introduction to what a robot is and what are the fundamental characteristics that make it different from other machines.

A robot is a programmable machine, equipped with sensors and motors.

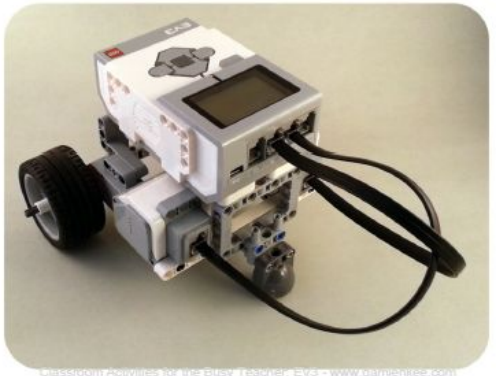
Introduction to the topic of environmental sustainability with particular reference to the problem of pollution and waste disposal and with an in-depth examination of the importance of recycling.

Construction of the Riley Rover through instructions and programming of the engine and proposal

Challenge 1: "How do we get him to run a tape measure without having a go?"

Instructions for assembling the Riley Rover http://www.damienkee.com/storage/rileyrover/RileyRover_BI.pdf

Students are left free to think and experiment.



- **lesson two:**

The first step is to solve the question of the first lesson on how to make the robot run one meter without attempts, in case not all the groups had arrived at the solution. Invite the groups that managed to solve the question to explain the solution to the other groups.

Resolution:

Option 1: measure the distance accomplished with one turn of the wheel and divide one meter by that distance,

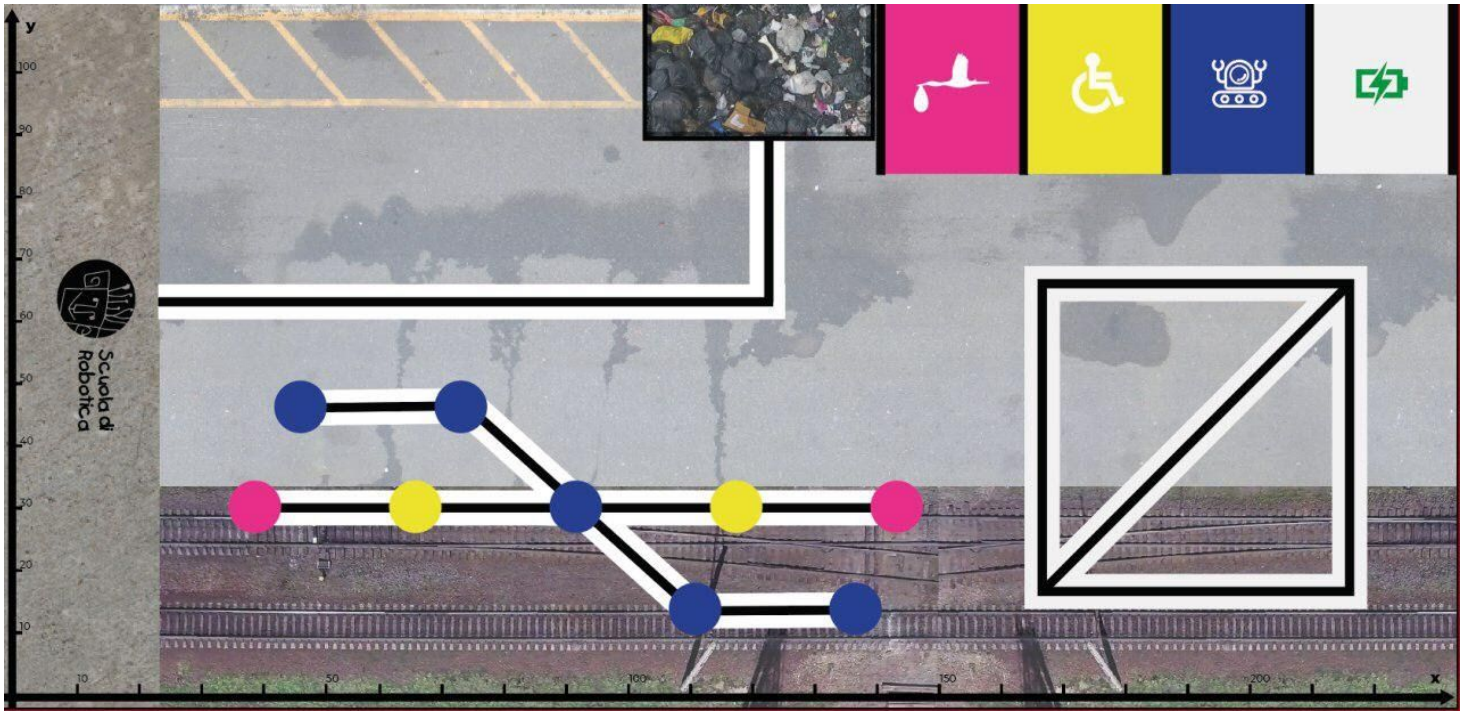
option 2: measure wheel circumference with formula 2πr (on tyres there you can find the radius size, but you can also invite children to measure the radius with the ruler) and divide one meter by that distance.

Resource to refer to: http://roboesl.eu/wp-content/uploads/2017/08/O1_Cur01_final_03.pdf

This phase is followed by the customization of the robot by each group. Students are invited to transform their robot into a machine that has the function of contributing to reduce pollution, recycling or the proper waste management. Students are invited to find a name for their machine before proceeding with the following mission.

Challenge 2: Learn how to make the robot make a 90° turn and make it follow the square (using the carpet as a reference).

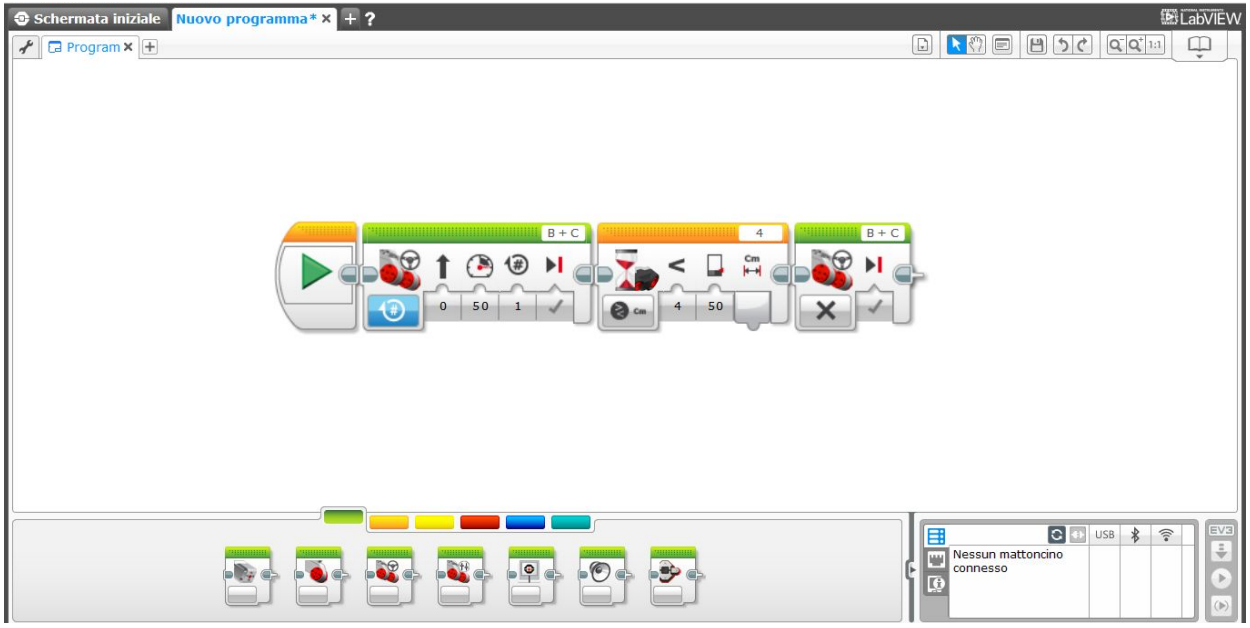
Challenge 3: Calibrate the robot's path to reverse into the parking plot (using the carpet)



- **lesson three**

Introduction of the ultrasonic sensor (figure 3), explanation of its operation by comparison with the animal world (e.g. bats, dolphins, etc...).

programming of the ultrasonic sensor using the "wait" block (programming example in figure 4)



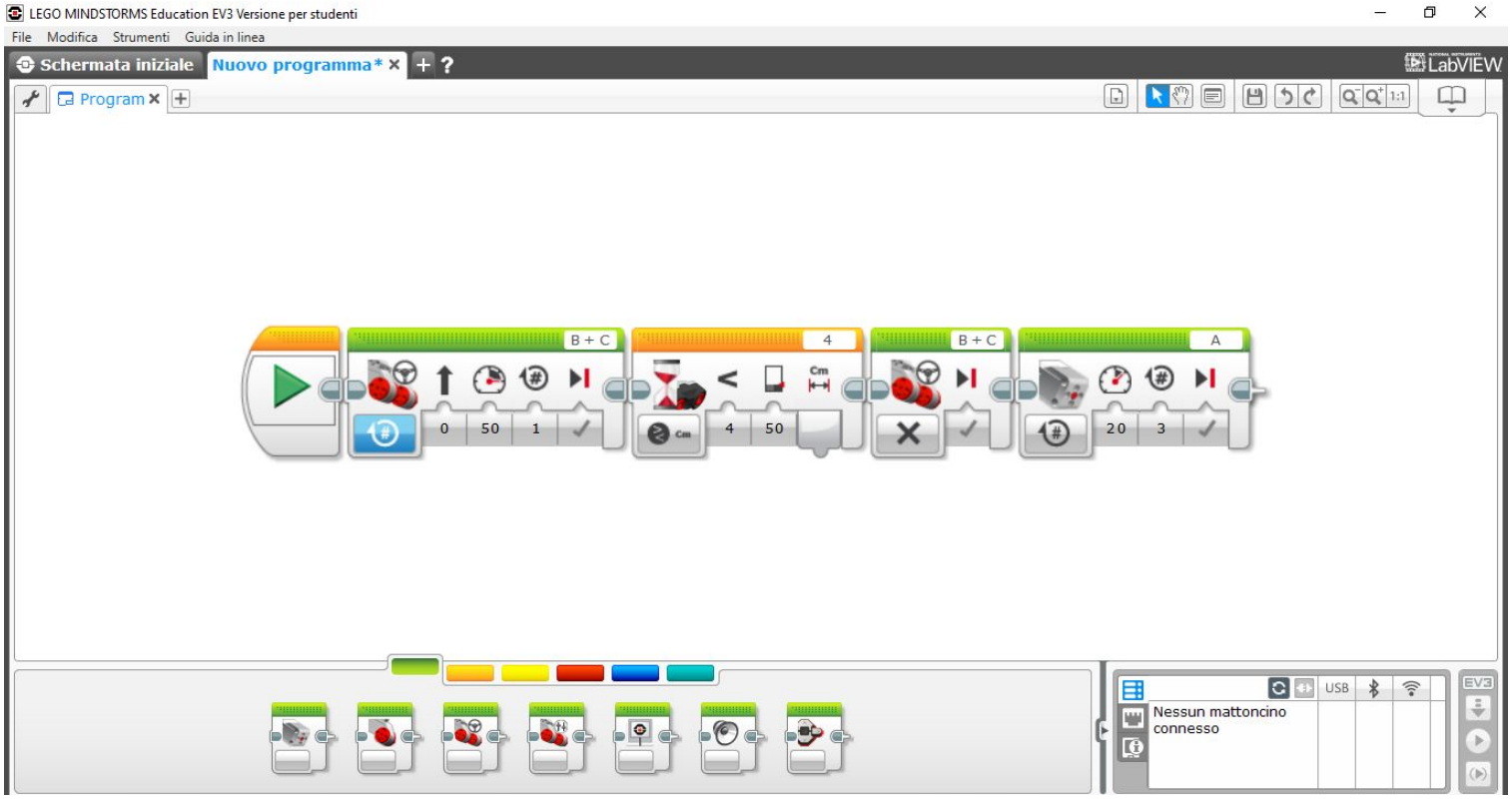
for advanced sensor use: http://roboesl.eu/wp-content/uploads/2017/08/O1_Cur02_final_03.pdf

- **lesson four**

Assemble the clamp following the instruction manual (http://www.damienkee.com/storage/rileyrover/RileyRover_BI.pdf)

programming of the motor to open and close the gripper

programming of the ultrasonic sensor to stop in front of an obstacle and grab it with the pliers (figure 5)



Learning outcomes

- In-depth study of ethical and environmental issues related to sustainability, waste management and recycling
- In-depth study of the machine and robot concept
- Problem solving and fine motor skills for the realization of the robot
- Programming skills for two different types of motors and the ultrasonic sensor