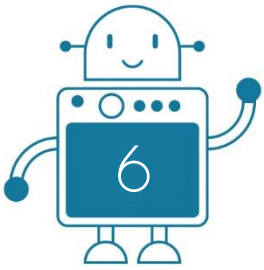


ROBOTS AND SCIENCE

STEMJAM Teaching Guide

Developing make spaces to promote creativity around STEM in schools

Acronym: STEMJAM
Project no. 2016-1-ES01-KA201-025470

www.stemjam.eu

Co-funded by the Erasmus+ Programme of the European Union

ROBOTS AND SCIENCE

ABSTRACT

Using mBot robot mounted in the first experiment, students will discover simple physics laws (friction and inclined plane) playing with the robot.

DIDACTIC OBJECTIVES

The purpose of this experiment is:

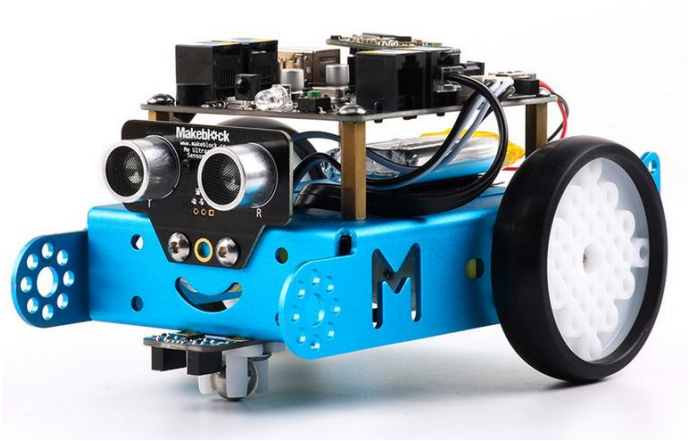
- Study Physics problems as Friction and an inclined plane with the robot.

STEM Subject: Science☒ Technology ☐ Engineering☐ Mathematics☒

Education Level: 12-14 years☐ 14-16 years☒

BOM (Bill of Materials Needed)

- mBot => Ref. 90054



- Inclined plane.

ACTIVITY DESCRIPTION

First, students study the physics of friction and the inclined plane. Using mBot, they experience the effect of friction and the inclined plane by adjusting the power of the mBot motors. The software is simply the command of the engines only.

Static frictions:
In principle, the speed of mBot depends in a linear manner on the power set on the motors. It is observe that the engine remains stationary at low power. This can be discussed with students and associated with static frictions.

Dynamic friction:
Increasing the power speed increases but depends on the material on which flows the mbot. With the same power the speed changes depending on whether mBot runs on the bench or on a scarf. This allows you to resume rolling frictions.

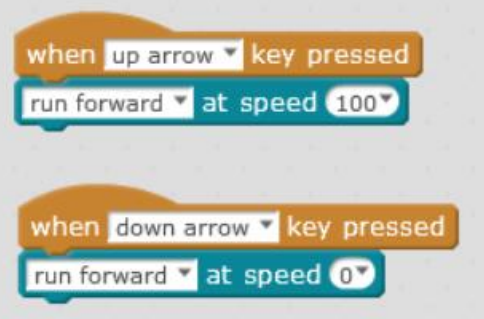
Inclined plane:
If mBot is placed on an inclined plane, the speed slows down as the force needed to overcome the friction is reduced by the longitudinal component of the gravity force. This allows you to face interesting discussions with the students on the components of the forces and on the law of dynamics.

There is a power regulation for which mBot stops, this allows to obtain the motor torque as a function of the power.

Set different powers**:**
The software is very simple, only the mBot engines are used. The engines are set with the same “speed”.

The Software is loaded with different levels of “speed” (power).

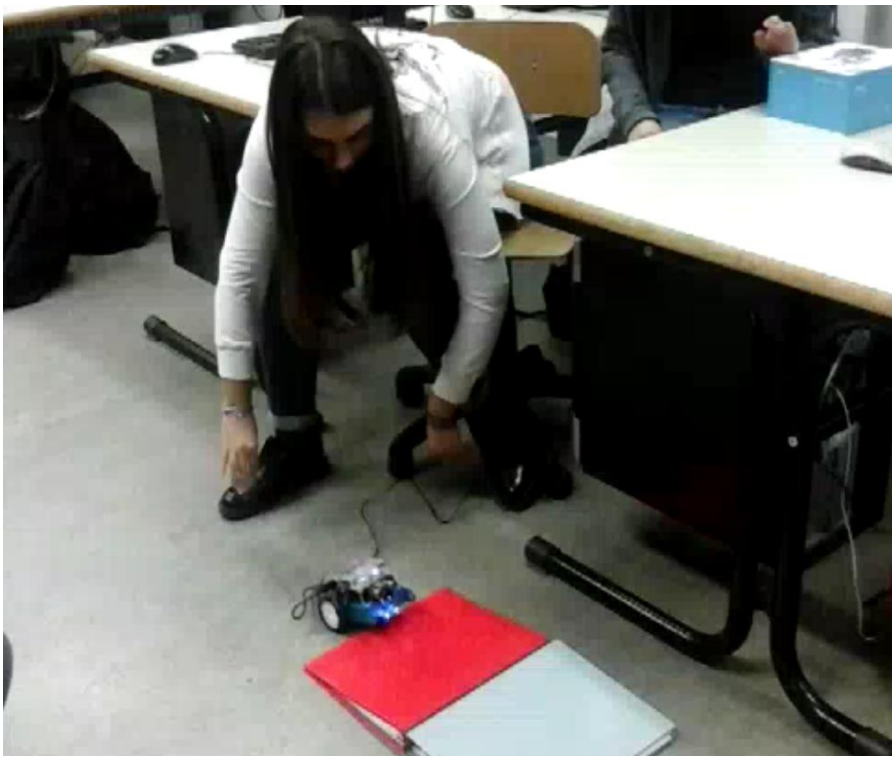
A simple software to activate and deactivate the engine can be realized using keyboard events.



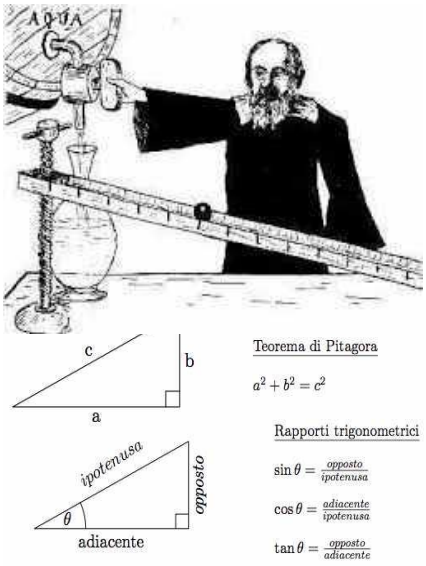
Observe the speed of mBot in different situations:

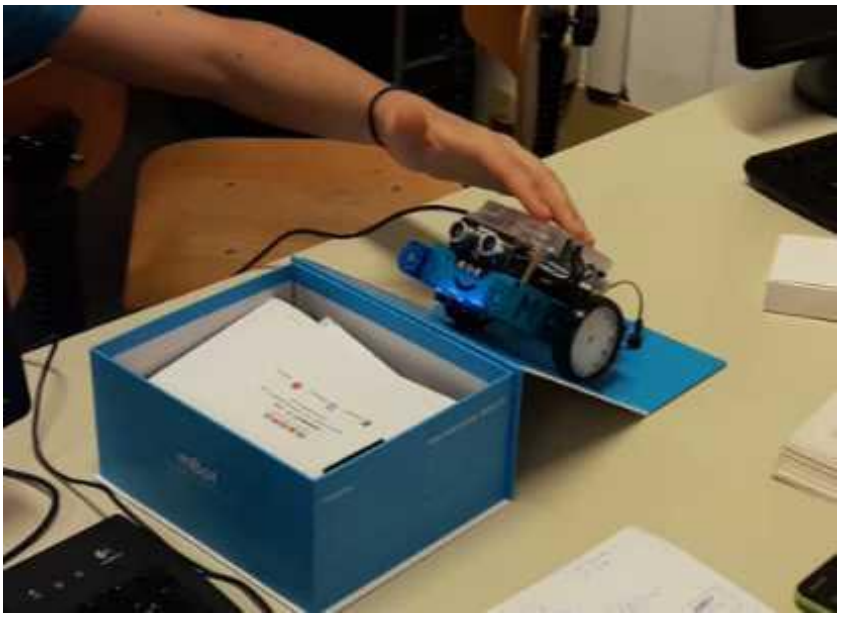
Under a certain “speed” value (power) the mBot remain stationary. Observe with students how the control is not on “speed” but on power and static friction are present.

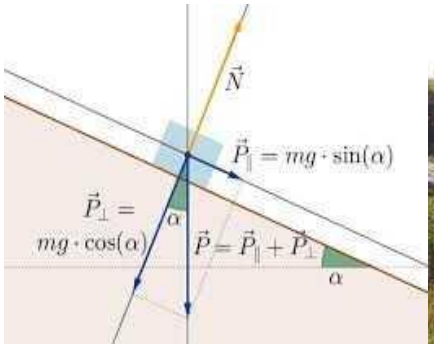
Running mBot on a scarf requires more power to get moving. Observe how you need to set a higher “speed” (power) value to get moving on a scarf. Discuss with the students the rolling friction.

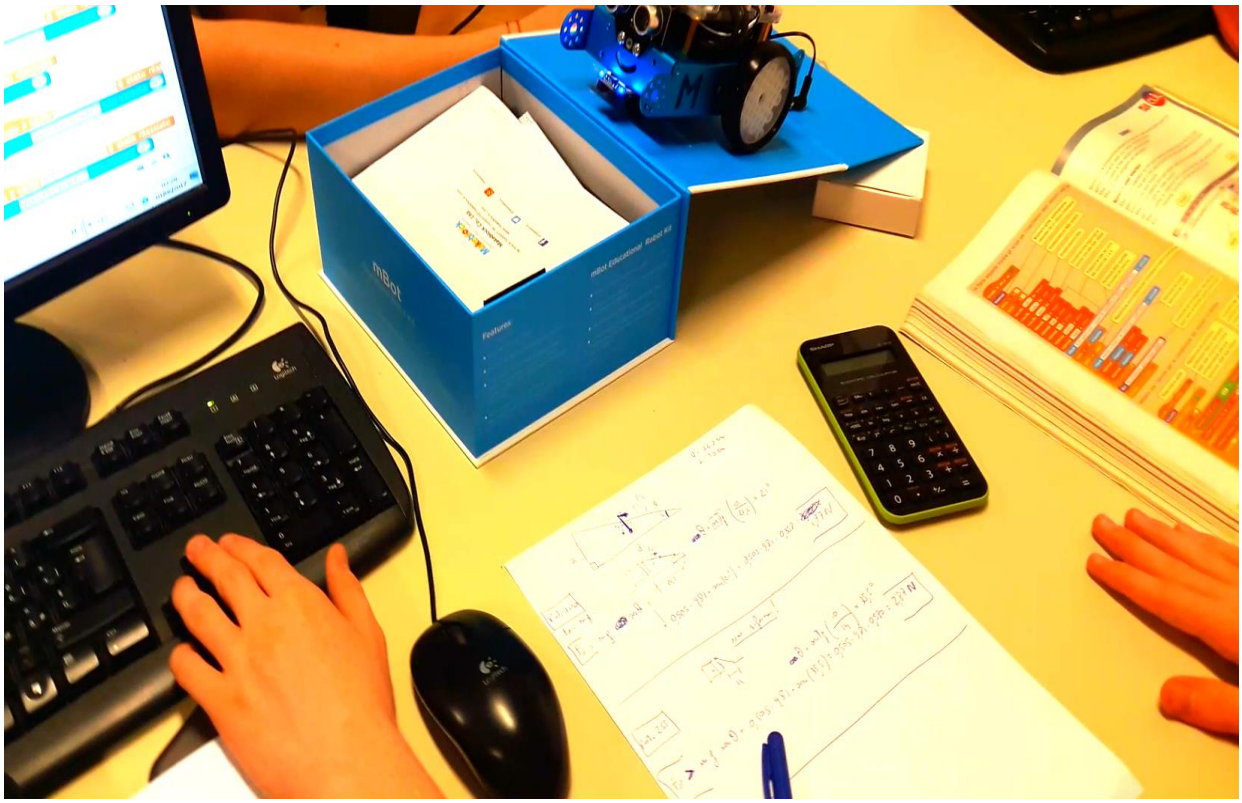


Calculate with the students the decomposition of the weight force and determine the component parallel to the motion. From the equilibrium conditions, estimate the torque supplied by the engine on the wheels according to the speed value.






$\vec{N}$
$\vec{P}_{\parallel} = mg \cdot \sin(\alpha)$
$\vec{P}_{\perp} =$
$mg \cdot \cos(\alpha)$
α
$\vec{P} = \vec{P}_{\parallel} + \vec{P}_{\perp}$
α



SCALABILITY

The design is based on students with "zero" preconditions for the IT part. The physics skills on frictions on the decomposition and balance of forces are the objectives of the teaching activity.