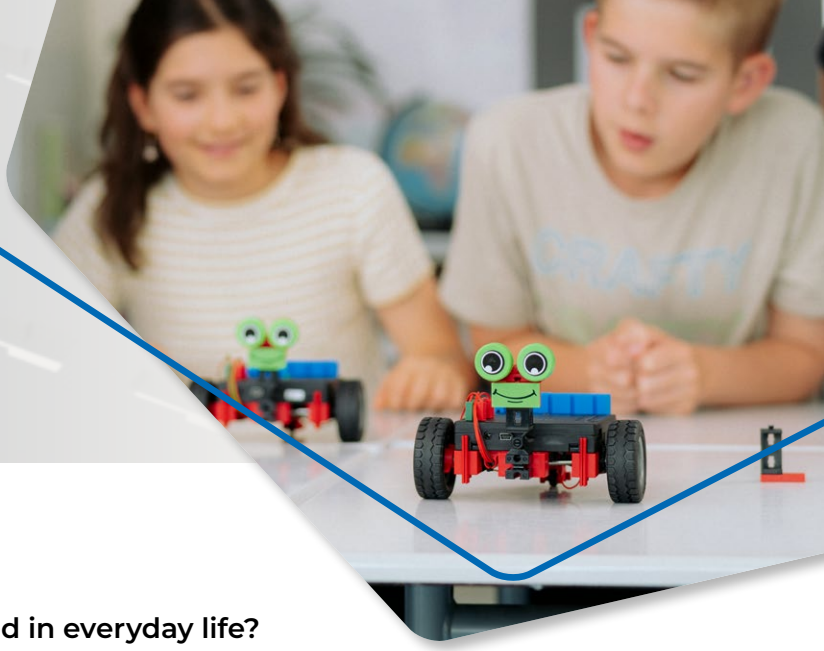
MODEL 1

RoXy

Keeps the track



KEY QUESTIONS:

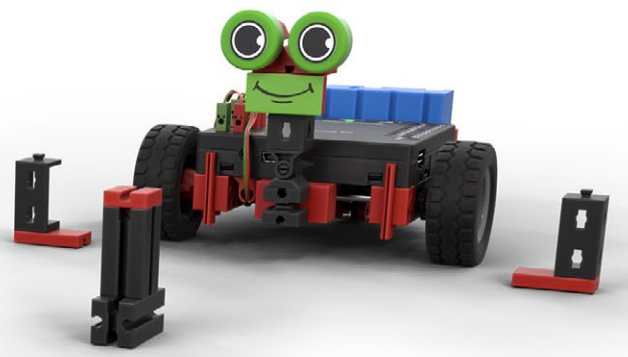
- **Where can a self-propelled robot be used in everyday life?** ***(Communication)***
- **What functions must the robot fulfill?** ***(Collaboration)***
- **Under what conditions should the system switch on or off?** ***(Critical thinking)***
- **What needs to be considered so that the robot can be used at different locations and the system functions as robustly as possible?** ***(Creativity)***

THE TEACHING CONCEPT AT A GLANCE

Grade level:	5-7
Time required:	1 double lesson (extendable up to 8 DL)
Degree of difficulty:	Model Programming up to
Model type:	mobile device, can be positioned individually and used for transportation/movement

MODEL DESCRIPTION / TASK

The students plan and realize a driving robot that can drive through an obstacle course. The robot switches on and starts its drive program when the On/Off button is pressed. The drive can be stopped using the same button.



EVERYDAY RELEVANCE

The automatic triggering of a process and the self-propelled driving of a robot have a strong motivational effect on students. The topic can be individualized with up to four additions to the basic task.

The topic could be integrated into preprofessional orientation with regard to IT-related occupational fields. Automated switching by recording physical variables is used here in many fields. In particular, the automated movement of objects is becoming increasingly important in home automation (robot vacuum cleaners, robot lawnmowers) and in automotive engineering.

SUBJECT REFERENCE

- **Information technology:** Programming basics, time loops
- **Physics:** Change of movement
- **Technology:** stable building, construction technology
- **Mathematics:** Circumference, units of length, angles
- **Biology:** Movement of individuals

LESSON PLAN

Introductory phase		
	Classroom discussion	• Announcement of the topic, if applicable Show “Robots from film and television”. • Inquire about what makes these robots tick, automation vs. life. • Inquire about scenarios in which self-propelled robot systemsare used (vacuum cleaners, lawn mowers, cars). • Discuss possible applications of the collected scenarios (e.g., robot vacuum cleaner, lawnmower and/or car). • Determine the requirements for the chassis. • Discuss the advantages and disadvantages of different types of drive (chain/wheels). • Justify the need for an emergency stop switch.
	Support, if necessary	• Show sensors, actuators and components from the assembly kit, use presentation media if necessary.
Planning Phase		
	Classroom discussion	• The procedure for building the model and the target function are developed jointly. • Sequence steps of the app are specified or discussed.

Partner or individual work	• The students familiarize themselves with the app and download the corresponding task. • Students define the useful functions of a self-propelling robot. • Students use the app to create the list of requirements for building the robot.
Optional: Partner or group work	• Optionally, the students sketch the potential robots. • The students discuss the results in the group and choose a design.
Construction Phase	
Partner or individual work	• The students use the app to build the driving robot. The app guides them through the program in short steps.
Programming Phase	
Partner or group work	• Students write the program for the driving robot (2 × motor, on/off button). The app guides them through the program step by step. • The app offers assistance. • The program is transferred to the RX controller.
Experimentation and Test Phase	
Partner or group work	• The driving robot is put into operation. • The first drives are carried out with the robot. • Possible malfunctions in the functional sequence must be found and eliminated. • Suggestions in the app can be used for troubleshooting. • Possible optimizations can be made to the hardware (e.g., wheel mounting, rotary roller) and programming.
Final Phase	
Optional: Presentation and allocation of differentia-tions	• The teacher may approach students eligible for differentiation. The robot's optimization possibilities (cornering, tentacles) are explained. • The app offers concrete ideas for fast learners.
Discussion in plenary	• Project debriefing in class. • Clarification of future possible applications in everyday life (transfer of the topic to everyday life), e.g., vacuum cleaner robots, lawn mowing robots, cars, drones.

METHODOLOGICAL AND INSTRUCTIVE TIPS

Differentiation options

Depending on the duration of the lesson series and the strengths of the students, the following are possible:

- specification of the position of the obstacle blocks including the travel routes,
- student measurement of the position of the obstacle blocks,
- the route program blocks are specified,
- self-measurement of the routes,
- self-programming of the routes,
- manual collection of obstacles.

Motivational aspects

All students are familiar with the topic of self-propelled robots from everyday life. In many households, robot vacuum cleaners and lawn mowers have long been part of everyday life as well as many other smart applications. Semi-autonomous cars are becoming increasingly common on the roads.

PROGRAMMING SKILLS

- Program start
- Continuous loop
- Integration of sensors
- Integration of actuators
- Loop **repeat until**
- Loop **wait**
- Use of variables and their change
- Working with subprograms

ADDITIONAL MATERIALS

Optional download:

- Circuit diagram
- Building instructions

- If available, a robot from film and television (BB8, R2D2, Wall-E), a robot vacuum cleaner, or another real object from the field of robotics/forklift trucks can be used for the introductory phase of the topic.
- Drawing media (paper, whiteboard, or projection screen).

FUNCTIONS OF THE MODEL AND THEIR TECHNICAL SOLUTIONS

Function of the sensors/actuators	Technical solution
Performing straight movement	Uniform and simultaneous control of the two drive motors
Performing a turn-left movement	Control of one of the two drive motors
Performing a turn-right movement	Control of one of the two drive motors
Start of a robot drive	Signal input on the On/Off button of the controller
End/emergency stop of a robot drive	Signal input on the On/Off button of the controller
Differentiation: quick turning on the spot (left/right)	Uniform and simultaneous control of the two drive motors in different directions

MATERIAL LIST

Sensors	Function
1 On/Off button on the controller	1. Switching on the robot 2. Emergency stop of the robot

Actuators	Function
2 motors	Movement