Tabletholder
Secured valuables

KEY QUESTIONS:

- How can a flat object be positioned so that its surface is clearly visible and not concealed? *(Communication)*

- Where and how are important objects staged and what advantages and disadvantages does this entail? *(Collaboration, critical thinking)*

- What types of alarm signals are suitable and how can corresponding physical values be created? *(Critical thinking)*

- What aspects of the design need to be taken into account to ensure that the system stands securely and the objects do not fall over or get damaged? *(Creativity, critical thinking)*

THE TEACHING CONCEPT AT A GLANCE

Grade level:	5–7
Time required:	2 double lessons
Degree of difficulty:	Model 🧩🧩🧩
	Programming 👉👉👉
Model type:	stationary device as a support for pictures, books, or smart devices with an optical alarm function when approaching or optical and acoustic alarm function when removing the placed object.

MODEL DESCRIPTION / TASK

The students plan and realize a holder for the presentation of flat objects (pictures, books, smart devices, etc.). The objects on display are secured. A proximity sensor for the "pre-alarm" (LED flashes) indicates that the distance to the viewer is too short. When the presented objects are removed, an optical and acoustic signal triggers an alarm.

A magnetic switch can be integrated as a main switch for differentiation.

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○ EVERYDAY RELEVANCE

Students are familiar with protecting and securing objects.
Security systems such as a Kensingtonlock, a cell phone lock in a sales exhibition, a bicycle or ski repair kit next to cycle paths/slopes etc., can be shown in the original or as pictures. Securing mechanical items poses a particular challenge.

○ SUBJECT REFERENCE

- **Physics:** Recording physical quantities (shape, movement)
- **Information technology:** Basics of programming, switches, sensors, time loops
- **Economics:** Sales strategies
- **Technology:** stable building, construction technology

○ LESSON PLAN

Introductory phase

	Classroom discussion	• Inquire about scenarios and everyday applications, how objects that need to be secured are presented. • Collect safety options and preventive warning options and discuss their advantages and disadvantages. • Collect and discuss alarm output options. • Collect desirable functions relating to alarm triggering (time delays, safety shutdown, shutdown function of a triggered system …).
	Support, if necessary	• Show sensors, actuators and components from the assembly kit, use presentation media if necessary.

Planning Phase

	Classroom discussion	• Announcing the topic. • Name the sensors and actuators used in the project. • Discuss the functional principle of the sensors and actuators used. • The teacher specifies the procedure using the work steps in the app.

Partner or individual work	•	The students familiarize themselves with the app and download the corresponding task.
	•	Students sort the important and less important features of an automatic safety system.
	•	The students prepare the list of requirements for the system to be built.
Optional: Partner or group work	•	The students sketch a possible system.
	•	The students discuss the results and agree on a design.

Construction Phase

Partner or individual work	•	The students use the app to build the automatic safety system. The app guides them through the building instructions step by step.

Programming Phase

Partner or group work	•	Students write the program for the automatic safety system. The app guides them through the program in short steps; the app provides assistance.
	•	The program is transferred to the RX controller.

Experimentation and Test Phase

Partner or group work	•	The safety system is put into operation and tested.
	•	Possible malfunctions in the function sequence (approach, noise output of the actuator, safe position …) must be detected and eliminated.
	•	Any optimizations must be made in the programming.
	•	Follow the app suggestions to carry out troubleshooting.

Final Phase

Optional: Presentation and allocation of differentiations	•	The app offers a differentiation option for fast learners:
	-	A main switch can be added using a reed switch. This can be used to activate the system or switch it to stand-by.
	•	The app helps realize the further procedure.
Discussion in plenary	•	Project debriefing in class.
	•	If applicable. Presentation of the differentiated solutions.
Competition	•	A sound measurement of the different solutions can be carried out as acompetition (the loudest system wins).

METHODOLOGICAL AND INSTRUCTIVE TIPS

Differentiation options
An additional sensor can be installed in the system for differentiation. This enables the system to be disarmed or armed by triggering a reed switch. This should be attached to the side of the system.

The reed switch could also be visually improved in the form of a flat magnet that is glued to an access card.

Motivational Aspects
Students are familiar with securing objects from everyday life; it provides intrinsic motivation. The independent realization of an actuator can lead to very creative solutions.

PROGRAMMING SKILLS

- Program start
- Continuous loop
- Integration of sensors
- Integration of actuators

- Loop **repeat until**
- Loop **if – then**
- Programming and calling up subprograms
- Waiting block

ADDITIONAL MATERIALS

Optional download:
- Circuit diagram
- Building instructions

- In the introductory phase, you can use locks you have brought with you (bicycle, Kensington etc.).
- Objects to be secured must be available (e.g. tablet, book).

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─○ FUNCTIONS OF THE MODEL AND THEIR TECHNICAL SOLUTIONS

Function of the sensors/actuators	Technical solution
Capturing an object to be secured	Triggering a button (permanent contact)
Falling below a safety distance	Record with the gesture sensor
Output of the "Safety distance" warning function	The red LED flashes
Output of the "Alarm" warning function	Rotational movement of a motor with sound transmission
Differentiation: Arming or disarming the system	Contact via the reed switch

○ MATERIAL LIST

Sensors	Function
1 RGB gesture sensor	Motion sensor on approach
1 button	Switching contact when removing the exhibit
Differentiation: 1 reed switch	Arming or disarming the system

Actuators	Function
1 LED, red	Visual warning function
1 gear motor	Acoustic warning function