We are the makers – IoT Learning Scenario

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1. Title	*Creating an alarm system*
scenario	The protection of the Oscar statuette was assigned to you by the Oscar committee (*Figure 1*). Therefore, you decided to create an alarm system that will notify you in case someone makes an attempt to steal it. Thus, your main goal for this activity is to create an Arduino-based system, equipped with appropriate sensors and electronical components, that will notify you in multiple ways (i.e. with audible and optical signals) when the statuette is removed. Apart from creating and programming the circuit, the students should be encouraged to breath some life to the project through crafting. The development of additional ideas (e.g. creating a system that will monitor the recorded activities of the alarm system, and remotely notify user) should be also encouraged. 
2. Target group	This scenario can be fit with ages: 12-15 years old
3. Duration	This scenario can be implemented in the classroom in 2 sessions (2-3 hours each)
4. Learning needs which are covered through the exercise	- Understanding basic Arduino theory (modules, add-ons, platform, programming language, etc.) - Understanding how sensors operate - Highlighting methods of implementing and embedding computational systems in a rather small scale (i.e. home).
5. Expected learning outcomes	- Building basic Arduino constructions - Effectively using block-based programming for basic projects - Basic Arduino programming (code) - Effectively using and programming with sensors
6. Methodologies	**Lesson 1: Welcome session** - Team formation - Small Introduction/Presentation: Presentation of the project scenario and objectives, setting the team goals, elaborating on the final outcome/result - Arduino: First familiarization **Lesson 2:** - Arduino Construction (boards, sensors, etc.) - mBlocks: Commands, compilation, execution - Arduino code: a set of commands are introduced, and explanation is provided **Lesson 3:** - Programming towards task implementation (mBlock or Arduino IDE). It is worth noting that half-baked solutions are also used in order to smoothly engage students in programming with mBlock

7. Place / Environment	Computer Lab
8. Tools / Materials / Resources	Projector, Audio system, Arduino kits, sensors
9. Step by step description of the activity / content	**Lesson 1** 1. Small team formation activity – team bonding 2. Demonstration of short videos about security systems and methods (immerse students in the context of the activity and provide them with basic information). 3. Presentation of the steps that will be followed towards project objectives achievement 4. Introduction to Arduino – short demonstration (through video and/or real time demostration) **Lesson 2** 1. Construction of Arduino in teams (boards/sensors attachment, etc.) 2. Demonstration of mBlock – easy to start with tasks for familiarization purposes (blinking LED, etc.) 3. Demonstration of Arduino coding platform – easy to start with programming tasks for familiarization purposes **Lesson 3** 1. mBlock and/or coding platform to implement the project (creating an alarm system) 2. Testing the solutions Discussion – conclusions Is this project related to real life? Does it address real risks?
10. Feedback	**Lesson 1**: Through discussion, the teacher decides whether the students have realized the importance of turning objects of daily life to smart. **Lesson 2:** The amount of the small projects' success (construction and programming) **Lesson 3**: Focus on the contribution of each team towards project completion
11. Assessment & Evaluation	**Lesson 1**: A short questionnaire is delivered for students to fill in. The questionnaire focuses on the topic of the project and aims at exploring students perceptions on topics related to the implementation of computational systems in a small scale. **Lesson 2:** Focus groups are organised in order to explore how each team worked towards the final goal, the team dynamics and the way the tasks were carried out and failures were encountered **Lesson 3:** The final project is evaluated from technical perspective and conceptual. It is interesting to see what type of tools the students used and mixed, how complex solutions they implemented, whether the project scenario was extended, whether ideas for optimal solutions were put forward. The evaluation is based on ongoing observations during the implementation of the project and review of final outcome (by the teacher).

Project description

Concept: This project is about creating and alarm system: when somebody tries to remove an object, audio and optical signals are activated.

Creating the circuit:

The following diagram (*Figure 2*) presents the way that the components of the circuit, meaning a LED, a buzzer and a photoresistor, should be connected. In the beginning, the breadboard should be supplied with power (5V) and ground (GND), through jumpers that are respectively connect to + and – columns of the breadboard. LED's anode (longer leg) is connected to one of the digital pins (13 in the example) through a 220 Ω resistor, while the cathode (shorter leg) is connected to ground. One of buzzer's pin is connected to one of the PWM digital pins (5 in the example) through a 100 Ω resistor, while the other pin is connected to ground. Finally, one of photoresistor's pins is connected to power (5V), while the other is connected to one of the analog pins (A0 in the example) as well as to ground, through a 10KΩ resistor. The entire system can be also powered by solar banks.

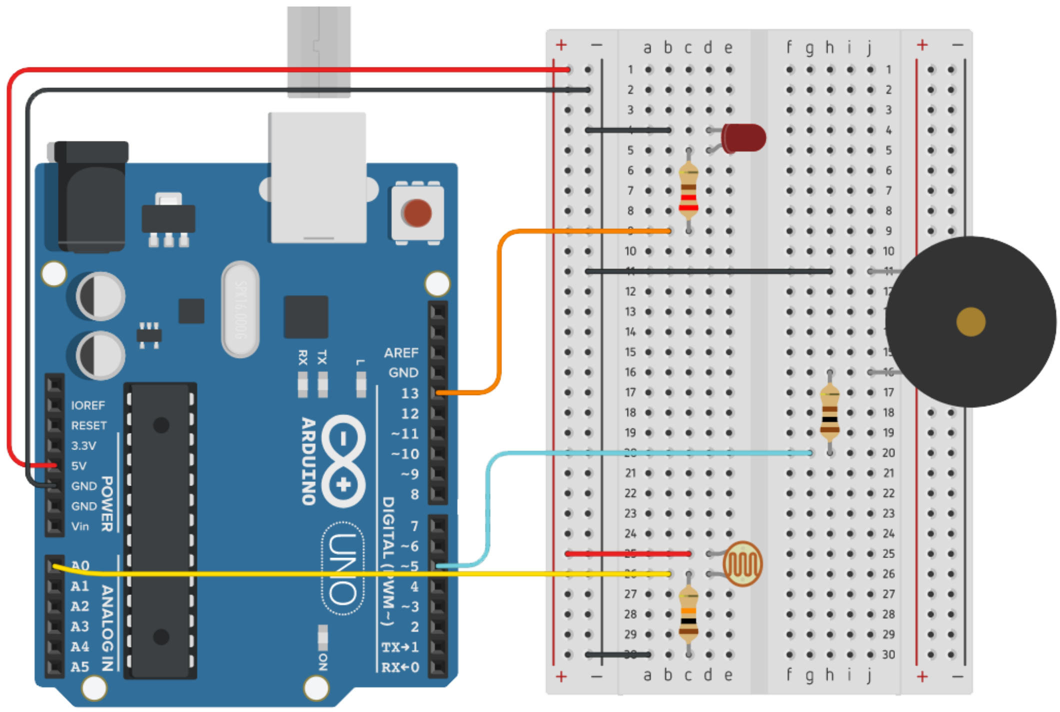


Figure 1: Diagram of the circuit

Programming the circuit:

The next step is to breath some life to the project through programming. According to the scenario, when someone attempts to remove the statuette, the buzzer and the LED are activated through the photoresistor. Therefore, a level of ambient light, over which the photoresistor will activate the rest of circuit's components, should be determined. Over this level, the buzzer should start buzzing while the LED should start blinking rather fast. The volume should be rather high in order for the sound to be easily perceptible.

The following script (*Figure 3*) is an indicative programming solution, created in a block-based programming software (mBlock). According to this script, a level of ambient light (i.e. 300) is set in order to act as a trigger point. Over this level, the photoresistor simultaneously instructs the buzzer and the LED to be activated. If the ambient light is lower than this level, then the two aforementioned components are deactivated.

Tip: To properly introduce this activity to your class, you are encouraged to provide half-baked solutions of the script (i.e. all the blocks separately, a semi-structured version of the script etc.).

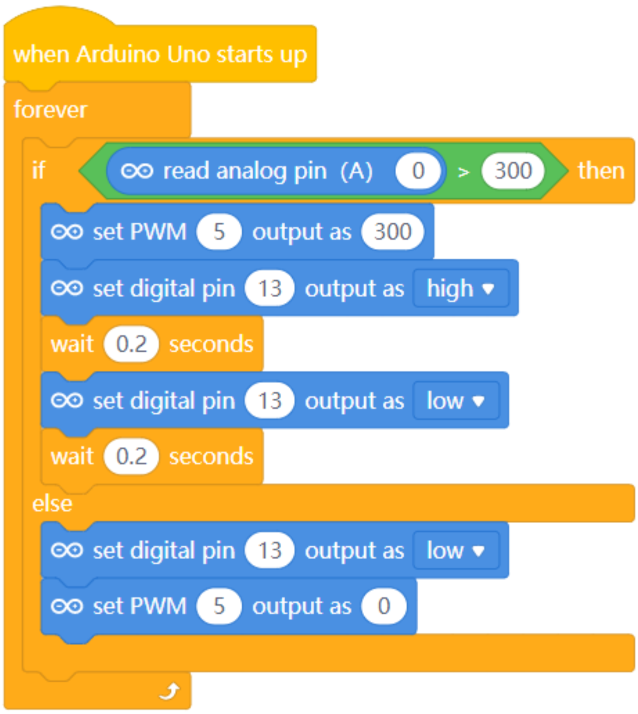
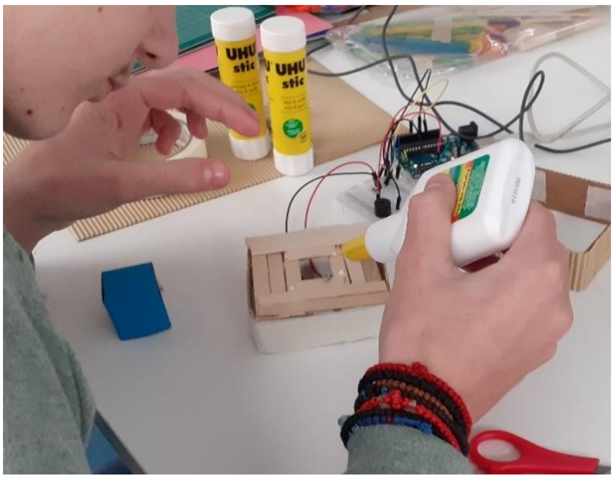
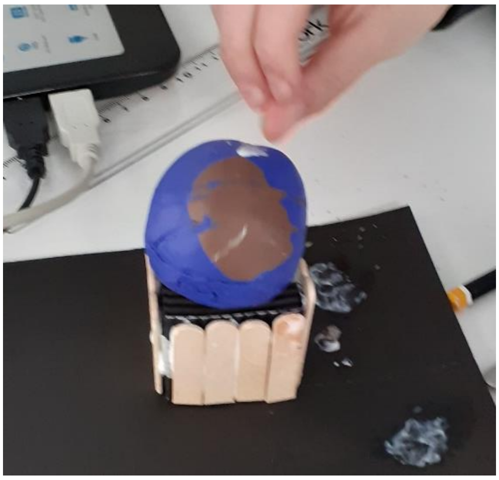


Figure 2: Indicative script for programming the alarm system

Creating a model for representing the alarm system:





As has already been mentioned, students should be also encouraged to create a model of the alarm system, and embed parts of the circuit in the structure. They can use easily accessible and/or recyclable materials (cardboards, plasticine, popsicles etc.) for their model, or design a 3d model that will be printed on a 3d printer.