We are the makers – IoT Learning Scenario

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1. Titel des Lernszenarios	***Herstellen eines intelligenten Lichtes (smart light)***
	Stellen Sie sich vor, Sie müssen ein Licht für die Türschwelle erstellen, das nur aktiviert wird, wenn sich jemand außerhalb Ihres Hauses befindet, oder ein Tischlicht für Ihr Zimmer, das nachts aktiviert wird und nur für den Fall, dass es irgendeine Art von Präsenz erkennt. Wie können Sie ein solches System erstellen? Welche elektrischen Komponenten und Sensoren benötigen Sie für die Anforderungen dieses Szenarios?
2. Zielgruppe	Schüler*innen zwischen 12 und 15
3. Dauer	Dieses Szenario kann in zwei Teilen ablaufen mit ca. 2-3 Stunden pro Sitzung
4. Erlernte Kompetenzen	- Verstehen der grundlegenden Arduino-Theorie (Module, Add-ons, Plattform, Programmiersprache usw.) - Verstehen, wie Sensoren arbeiten - Hervorheben von Verfahren zum Implementieren und Einbetten von Rechensystemen in einem kleineren (d. h. im häuslichen Bereich) oder einem größeren Maßstab (d. h. in einer städtischen Umgebung)
5. Erwartungshorizont	- Aufbau grundlegender Arduino-Konstruktionen - Effektiv blockbasierte Programmierung für Basisprojekte verwenden - Grundlegende Arduino-Programmierung (Code) - Effektives Verwenden und Programmieren von Sensoren
6. Methoden	**Lektion 1: Begrüßungssitzung** - Teambildung - Kleine Einführung / Präsentation: Präsentation des Projektszenarios und der Projektziele, Festlegung der Teamziele, Ausarbeitung des Endergebnisses / Ergebnisses - Arduino: Erste Einarbeitung **Lektion 2:** - Arduino-Konstruktion (Platinen, Sensoren usw.) - mBlocks: Befehle, Kompilierung, Ausführung - Arduino-Code: Es werden eine Reihe von Befehlen eingeführt und Erklärungen gegeben

	Lektion 3: - Programmierung zur Aufgabenimplementierung (mBlock oder Arduino IDE). Es ist erwähnenswert, dass halbgebackene Lösungen empfohlen werden, um die Schüler reibungslos in die Programmierung mit mBlock einzubeziehen.
7. Ort / Umgebung	Computerraum
8. Werkzeuge / Materialien / Resourcen	Projektor, Audiosystem, Arduino Bausätze, Sensoren

9. Step by step description of the activity / content	**Lesson 1** 1. Small team formation activity – team bonding 2. Demonstration of short videos about sensor sensitive lightning 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 circuits in teams (boards/sensors attachment, etc.) 2. Demonstration of mBlock – easy to start with tasks for familiarization purposes (blinking LED, etc.) 3. Alternatively, 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 a smart light) 2. Testing the solutions 3. 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 one, and/or implementing the same scenarios in a larger/urban scale. **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 as well as a large 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 a light that is activated when presence is detected, and occasionally, when dark falls.

Scenario for introducing the concept:

Imagine that you need to create a light for your door's threshold that will be activated only when someone is outside your house, or a table light for your room that will be activated during the night and only in case that it will detect any kind of presence. How can you create such a system? Which electrical components and sensors do you need for the needs of this scenario?

The following images are indicative since their main goal is to graphically illustrate the concept of the project. In details, a sensor (PIR sensor) (1a) that is able to detect motion of warm bodies (humans or animals) in a specific range, is implemented. When the sensor detects presence, the corresponding light turns on (1b, 1c). The project is related to emerging issues in regards to the environment and consequently brings up issues related to environmentally friendly solutions implemented in a smaller or a larger scale. The development of additional ideas that will also promote cooperation and work in groups (e.g. creating a street with smart street lights), as well as the implementation of crafting for breath life to the project, should be also encouraged.

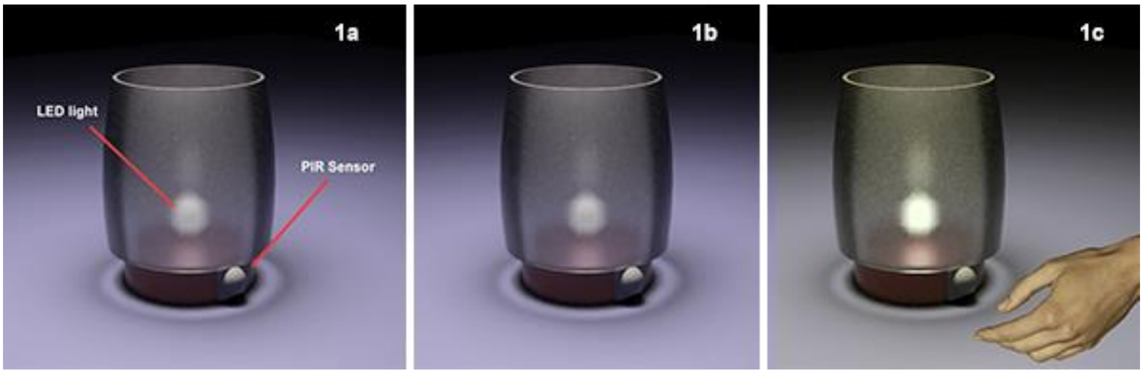

Figure 1 Indicative solution of a smart table light.

Creating the circuit:

The following diagram (*Figure 2*) presents the way that the components of the circuit, meaning a LED, a PIR Sensor, and a photoresistor (optional), should be connected. In the beginning, the breadboard should be supplied with power (5V) (**1**) and ground (GND) (**2**), through jumpers that are respectively connect to **+** and **–** columns of the breadboard. Use one of the digital pins (**3**) (pin 13 in the example) to connect the anode of your LED (**4**) through the 220Ω resistor (**5**). Connect the cathode of your LED to ground (**6**) in order to create a closed circuit. Use, again, one of the digital pins (**3**) (pin 2 in the example) to connect the signal pin (**8**) of your PIR sensor (**7**). Use the remaining two pins to provide 5V power and ground to your sensor. Connect one of photoresistor's (**9**) legs to power (5V), and the other to one of the analog pins (**10**) (pin A0 in the example), as well as to ground through the 10KΩ resistor (**5**).

Note: Keep in mind that some PIR sensors do not have the signal pin in the middle. Therefore, before connecting the sensor to your breadboard, please check the label on each pin.

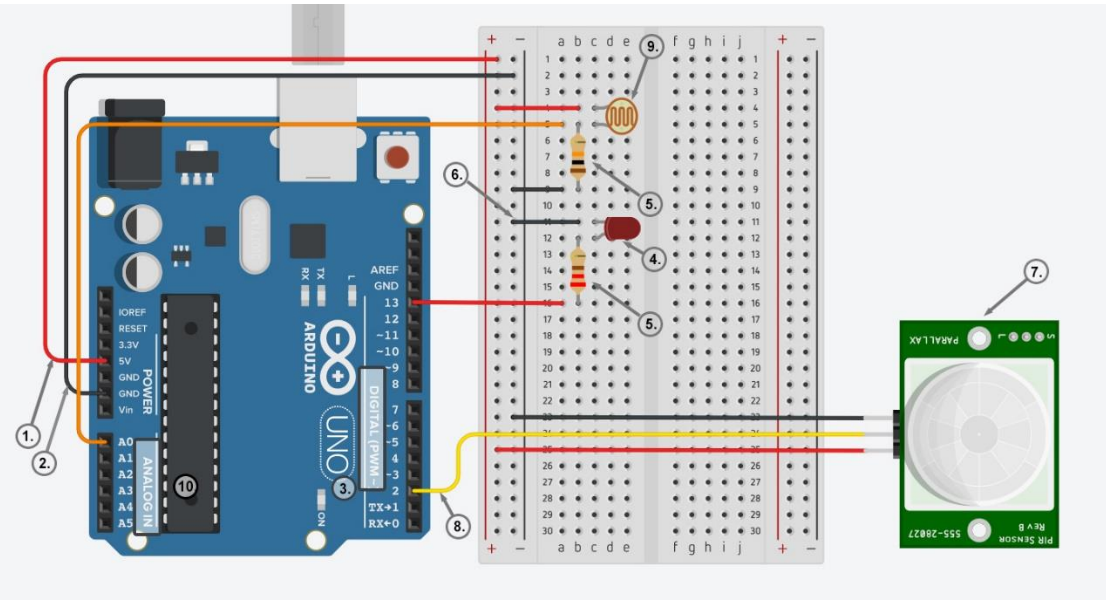

Figure 2: Diagram of the circuit

Programming the circuit:

The next step is to breath some life to the project through programming. According to the scenario, when presence is detected the LED light turns on. Optionally – and according to the selected scenario – the LED light can be activated when presence and dark are simultaneously detected.

The following script (*Figure 3*) is an indicative programming solution, created in a block-based programming software (mBlock). According to this script, two conditions should be valid in order for the LED to be turn on, namely the PIR sensor to detect some kind of presence and a level of ambient light (i.e. 300) to be set in order to act as a trigger point. Under this level, and some kind of presence is detected, both sensors instruct the LED to turn on. If the ambient light is over this level, and no presence is detected, then the LED is not turning on.

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.).

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Figure 3: Indicative script for programming the smart light

Creating a model for representing the smart light:

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