STEAM EmbRaCe

A STEAM project for Empathy, Resilience and Creativity

Introduction to Arduino

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Summary	
This course will cover the basics of using Arduino for robotics and automation projects. Students will learn how to wire, program and control various sensors and devices using the Arduino platform. Additionally, the course will cover some of the latest developments in robotics and automation and how these technologies are being used in various fields. This course is suitable for students interested in pursuing careers in engineering, technology, or related fields.	
Key elements	
Keywords	Arduino / Robotics / Sensors / Circuits / Simulation / System / Engineering / Electronics / Microcontroller / Softcoding
Subject	Computer Science / Technology / Physics / Engineering
Age of students	12 - 17
Preparation time	4 - 10 hours (depending on prior knowledge of topics)
Teaching time	4 - 6 hours
Online teaching material	TinkerCad (online app)
Offline teaching material	Arduino IDE (desktop app) / Steam EmbRaCe “Robotics & Automation” presentation
Resources used	Arduino microprocessors / breadboards / LEDs / Jumper wire cables / 220Ω resistors / other sensors / modules

Licenses
Trends
Automation in Agriculture / Internet of Things / Smart Home Applications / Motion Activated Systems / Remotely Controlled Systems / Alarm Systems
21st century skills
Creativity / Critical Thinking / Problem Solving / Collaboration and Teamwork / Technology Literacy

Lesson Plan

Activity	Description	Duration
Introduction to Circuits' theory, Arduino hardware and sensors	Using the Steam EmbRaCe "Robotics & Automation" presentation, guide your class through the basic meanings of circuit theory, electronics and sensors. Connect those concepts with familiar notions of everyday life (e.g. make the connection between sensors and the human sensory system). Make a reference to Ohm's Law and the Arduino hardware basics, such as the Arduino board, LEDs, breadboard, cables etc. Emphasize on the equation and units of measurement, VCC and ground notions.	45 min
Software demonstration	Familiarize your class with the interface of TinkerCad, a free online application that can be used to simulate an Arduino - based system. https://www.tinkercad.com/circuits	15 min
Circuit construction (simulation)	Use Tinkercad to construct a simple circuit. Begin by locating in TinkerCad the Arduino microprocessor and the sensors to be used. Use a standard schematic and go step by step constructing the circuit. Take advantage of TinkerCad's "Blocks + Text" Code Edit Mode to allow students to work with block code which translates into C++ code in real-time.	30 min
Circuit construction (hands-on, easy)	Break-up the class into groups of 3-4. Familiarize your class with the Arduino IDE, the open source desktop application typically used for coding Arduino projects. https://www.arduino.cc/en/software Allocate each team an Arduino kit with all the necessary components required to build the simulated circuit from the previous activity. Walk the classroom and assist teams as needed.	45 min
Circuit construction (hands-on, advanced)	Introduce new features into the circuits built into the previous activity, chosen by the teams themselves. For example, one team might choose to add a push button that lights a LED light, while another team might choose to add a temperature module. Assist teams in researching the Internet and/or the Arduino forum (for wiring and coding instructions.	45 min

SEL practices

The following techniques support self-awareness and self-management which are the two main domains of the CASEL model in social and emotional learning.

At the beginning of the course we identify students' emotional state by following the activity "Practice for identifying emotional state".

At the end of the lesson students reflect upon their work by following the activity of Reflection.

After the reflection they practice the square breathing technique and the aim is for them to learn to practice this every time they are about to begin a challenging activity.

Assessment

Use the following exercises of graded difficulty for student assessment:

1. Identify the resistance of a given resistor based on its color code.
2. Understand if any given module acts as an input or an output to an Arduino-based system.
3. Identify the sensors and modules needed to construct a given real-world system (e.g. an alarm clock).
4. Understand how current flows through a breadboard in a given system.
5. Understand what a given project does by reviewing its wiring and code.
6. Build a small scale system from scratch that performs a given task, or one chosen by the students themselves.

About STEAM EmbRaCe project

This Learning Scenario has been created in the framework of the STEAM EmbRaCe project.

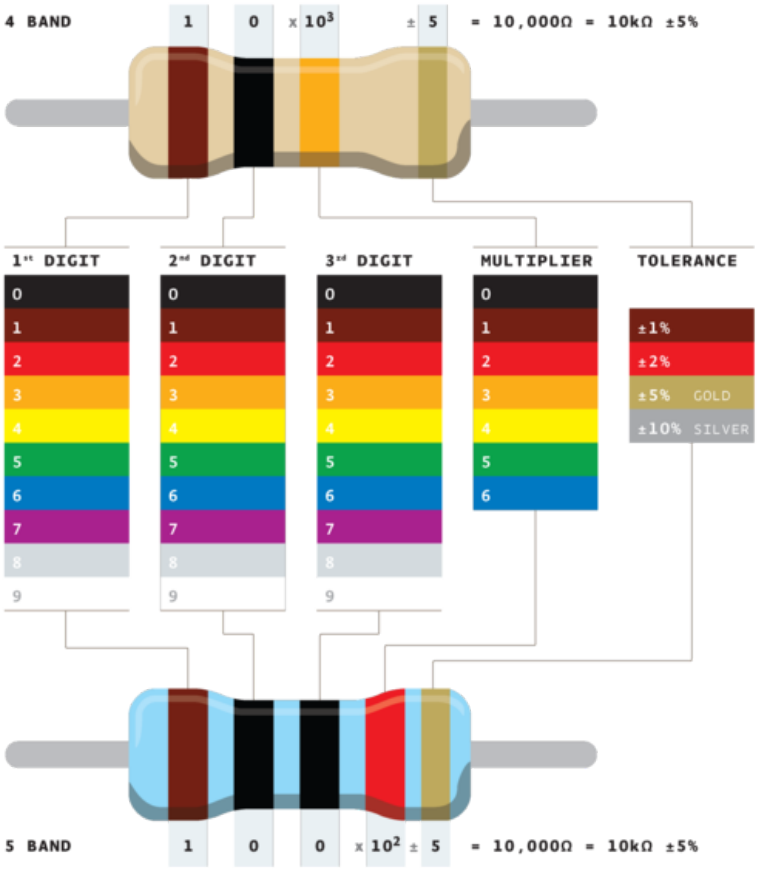
STE(A)M EmbRaCe aims to promote inclusion by engaging and inspiring students from different backgrounds. Students work on real-world STE(A)M problems, which will help develop their cultural empathy, resilience, and creative thinking. The idea is to create digital content which will be ready to be used by teachers in any classroom setting. More specifically, the project will allow the development of a 7-week course and teacher training on how to use the developed material with students.

Find out more about the STEAM EmbRaCe project:

https://steamingthefuture.gr/steam-embrace/

Annex 1

Resistor color code chart



Source: https://commons.wikimedia.org/wiki/File:Resistor_color_code.png

Annex 2

Use the following Arduino project repositories to find a project that suits the level of competence of your class and/or their specific interests:

https://www.instructables.com/Arduino-Projects/

https://circuitdigest.com/arduino-projects

https://projecthub.arduino.cc/

Use the following websites to find information on how different modules and sensors interface with the Arduino board:

https://arduinomodules.info/

https://lastminuteengineers.com/electronics/arduino-projects/

Use the Arduino forum to find solutions to common problems:
https://forum.arduino.cc/