Co-funded by the Erasmus+ Programme of the European Union

We are the makers – IoT Learning Scenario
Prosthesis controlled by electromyographic sensor

1. Title of the Scenario	***How to make a Prosthesis controlled by electromyographic sensor***
2. Target group	This scenario can be fit for secondary school and vocational people
3. Duration	This scenario can be divided in 4 two hour lessons
4. Learning needs	Drawing skills, experience with 3D modelling and printing, manual skills
5. Expected learning outcomes	Awareness of drawing 3D object socially useful Application of electronics to make a 3d printed prosthesis functional
6. Methodologies	Lesson 1: Design of the prosthesis Lesson 2: Mechanical assembly and introduction to electromyography Lesson 3: Programming of sensors and electronics Lesson 4: Testing the functionality of the electromyographic sensors
7. Place / Environment	Classroom
8. Tools / Materials / Resources	Computer with software CAD, one of each three students Kits to assembly prosthesis Documentation to assembly prosthesis Software to program sensors Hardware platform to program electronic boards EMG sensors

9. Step by step description of the activity / content	Lesson 1: Design of the prosthesis 1. In video conference or in person you will talk to the person who needs a prosthesis. We will decide together which model optimizes comfort and usability. 2. A first 2D drawing is made, which will be implemented on a 3D drawing software. Lesson 2: Mechanical assembly and introduction to electromyography 1. The prosthesis designed in the first lesson, properly modified by experts and printed, will be assembled. 2. It will explain what electromyography is, in what areas it is used and for what purpose. Lesson 3: Programming of sensors and electronics 1. We understand how the sensor should be to detect the correct signal. 2. We program the board, which when the person contracts the muscle on which the sensor is placed, the electrical signal emitted and read by the EMG sensor will be used to set in motion the prosthesis. Lesson 4: Testing the functionality of the electromyographic sensors 1. We test the entire designed system and we make the necessary changes in the programming to optimize it, so that the prosthesis is set in motion when the muscle is really contracted and stays in static position when the muscle is relaxed.
10. Feedback	Lesson 1: Quality of the 3D model Lesson 2: Efficiency of prosthesis and learn the use of electromyography Lesson 3: Knowledge of programming to control wearable sensors Lesson 4: What we have learn from these lessons
11. Assessment & Evaluation	Lesson 1: Each team managed to design a prosthesis? Lesson 2: Did they understand how to assemble the prosthesis and what is electromyography? Lesson 3: Did they manage to read a muscle signal and program the

	microcontroller? Lesson 4: What did they learn from the final test?