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EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS - EMERALD

Multiplier Event on the Experiencing of e-Learning Platform for Biomechatronics,

hosted by Bizzcom s.r.o. company, in Bucany, Slovakia
13th September 2023

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EMERALD: European network for 3D printing of biomimetic mechatronic systems
EEA & Norway Grant - Contract No. 21-COP-0019

MULTIPLIER EVENT on Experiencing of e-learning platform for bio-mechatronics

organized by BIZZCOM s.r.o. company, Slovakia

– Event agenda- 13th of September 2023

	Session 1 – EMERALD e-learning platform for bio-mechatronics
8:30	Registration of participants to the Multiplier Event
9:00	Opening and Welcome ceremony: Branislav Rabara – Director of BIZZCOM s.r.o. company (Slovakia)
9:15	EMERALD project overall presentation – progress, actions, KPIs, perspectives / details about the event – Associate Prof. Răzvan Păcurar (Technical University of Cluj-Napoca, Romania)
9:30	EMERALD main concept of the EMERALD e-learning platform for bio-mechatronics - Associate Prof. Răzvan Păcurar (Technical University of Cluj-Napoca, Romania)
9:45	EMERALD – e-learning platform for bio-mechatronics – presenting of CAD / CAE virtual laboratory room e-learning facilities - (Associate Prof. Răzvan Păcurar – Technical University of Cluj-Napoca - Romania)
10:15	EMERALD – e-learning platform for bio-mechatronics – presenting of 3D scanning and 3D printing virtual laboratory rooms e-learning facilities - (Associate Prof. Filip Gorski – Poznan University of Technology - Poland)
10:30	EMERALD – e-learning platform for bio-mechatronics – presenting of Testing and Materials characteristics virtual laboratory room e-learning facilities - (Associate Prof. Diana Băilă – University Politehnica Bucharest - Romania)
10:45	EMERALD – e-learning platform for bio-mechatronics – presenting of Sensoring, Programming and Assembling virtual laboratory rooms e-learning facilities - (Prof. Filippo Sanfilippo – University of Agder - Norway)
11:00	EMERALD – e-learning platform for bio-mechatronics – presenting of VR / AR virtual laboratory room e-learning facilities - (Martin Zelenay – BIZZCOM - Slovakia)
11:15	Conclusions about the content and future perspectives on improving the use of the EMERALD – e-learning platform for bio-mechatronics/ realizing of bio-mechatronics systems to support people with special needs (amputated arms) (Technical University of Cluj-Napoca, Romania)
11:30	Coffee break / Press conference

AGENDA

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	Session 2 – Experiencing the – EMERALD e-learning platform for bio-mechatronics / VR / AR / MR experience
12:00	Opening of the session and organizing aspects related to the EMERALD e-learning platform for bio-mechatronics experiencing / dividing in groups (Martin Zelenay – BIZZCOM (Slovakia)
12:15	Experiencing the virtual rooms of the EMERALD e-learning platform for bio-mechatronics (testing on the computer) / Experiencing of VR applications using VR googles / Experiencing AR applications using tablets /collection of feedbacks (all partners + participants to the Multiplier Event)
13:15	Conclusions about the experiencing of the EMERALD e-learning platform for bio-mechatronics and discussions related to feedbacks /aspects that are still necessary to be improved in the e-learning platform / round table discussions (Martin Zelenay – BIZZCOM (Slovakia)
13:45	Comments and discussions on the possibility of joining different projects / consortium / EU Networks - Branislav Rabara – Director of BIZZCOM s.r.o. company (Slovakia)
14:15	Closing words / ending of Multiplier Event
14:30	Lunch break

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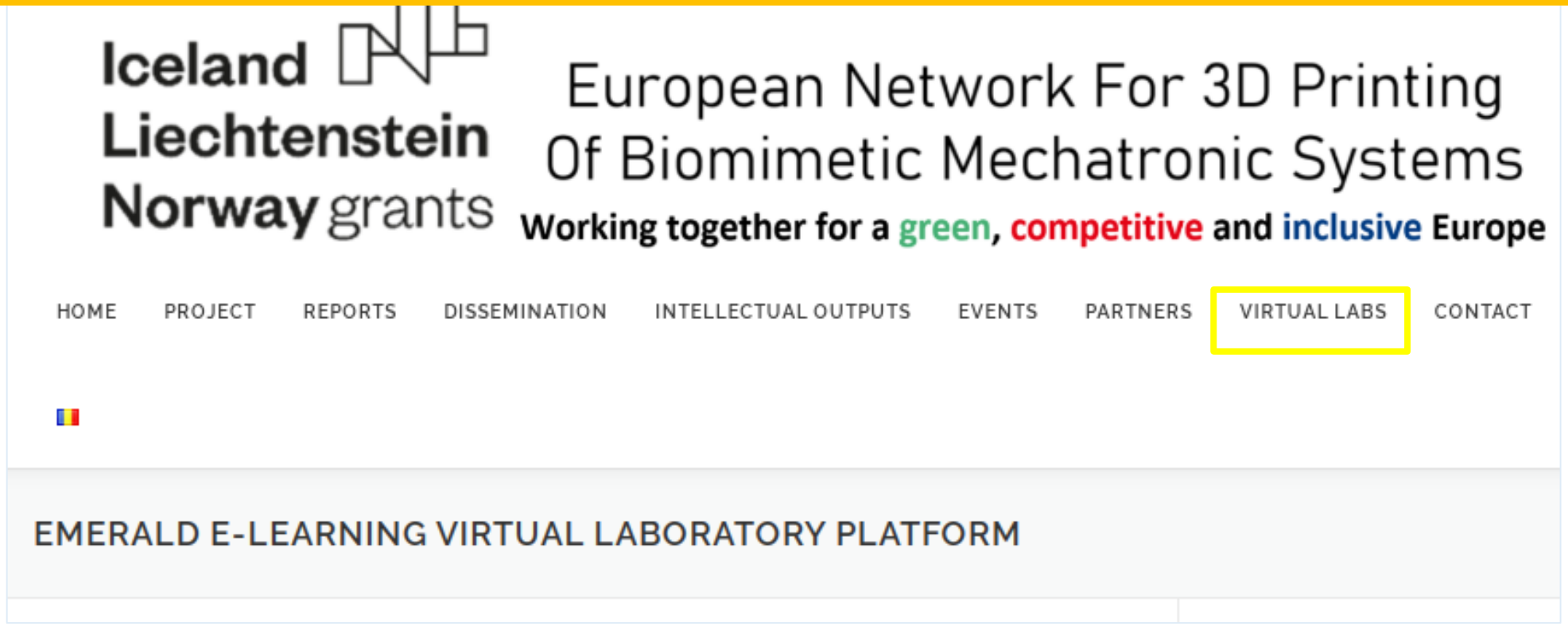
EMERALD – e-learning platform for bio-mechatronics Sensoring, Programming and Assembling virtual laboratory room e-learning facilities

UiA



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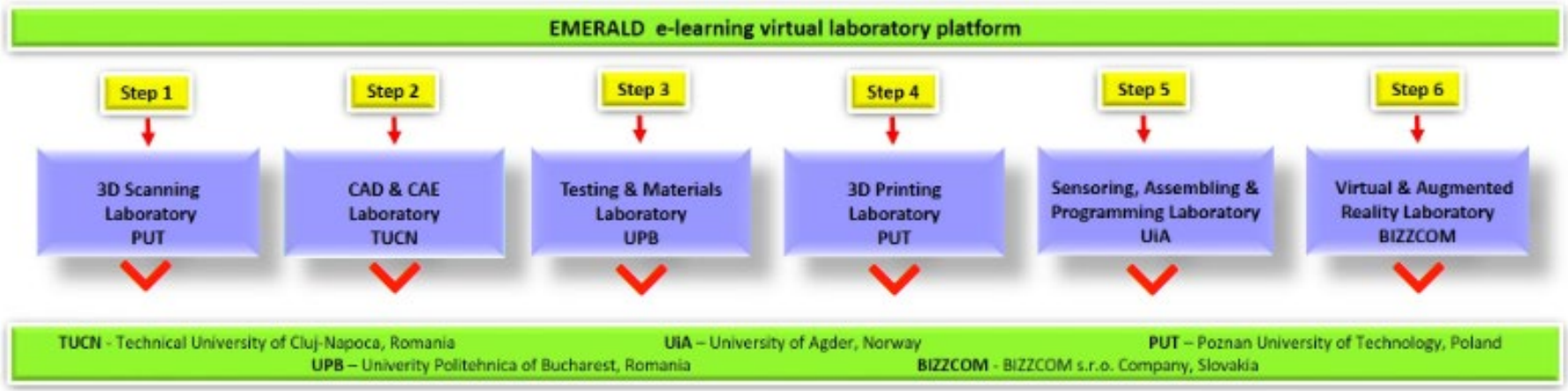
HOME | PROJECT | REPORTS | DISSEMINATION | INTELLECTUAL OUTPUTS | EVENTS | PARTNERS | VIRTUAL LABS | CONTACT

Please click on the tooltips on the diagram bellow to virtually visit our laboratories.

For a better understanding of the EMERALD e-learning virtual laboratory platform, which includes 3D scanning, CAD, CAE, testing and material characterization, 3D printing, sensorizing, assembly, programming, AR & VR, it is advisable to access the virtual laboratories by following the steps that are outlined in the diagram given below. By following the steps in the indicated order, this will lead to a more comprehensive understanding of the logical process involved in conceiving and developing of new biomimetic mechatronic systems to be realized utilizing 3D printing technologies.



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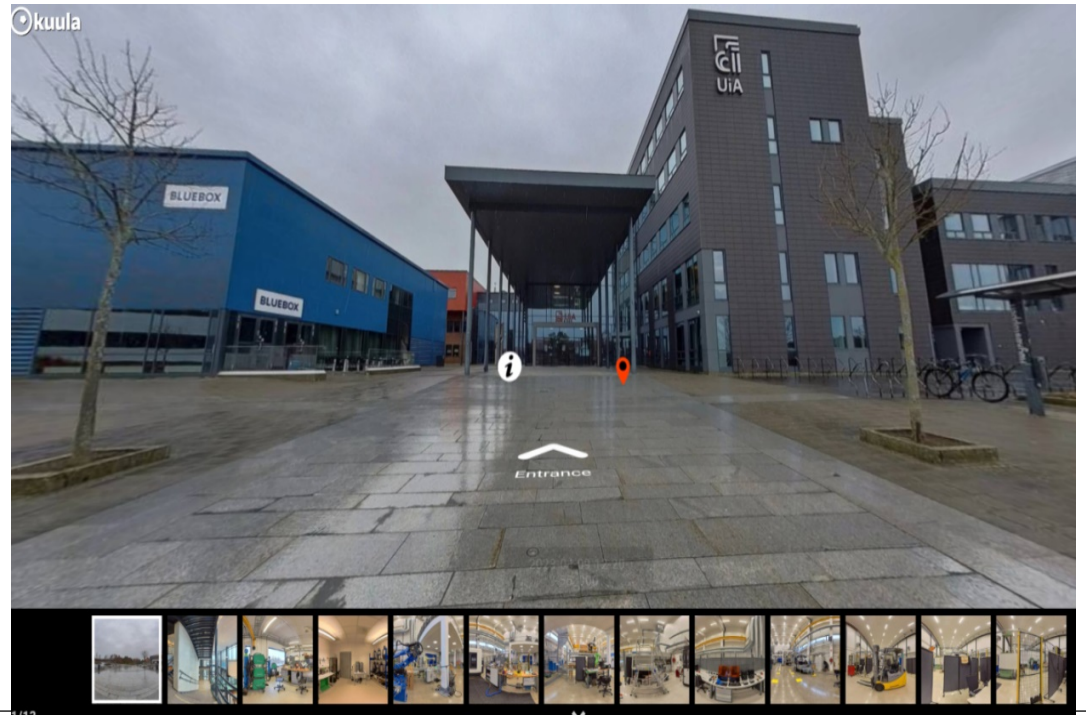
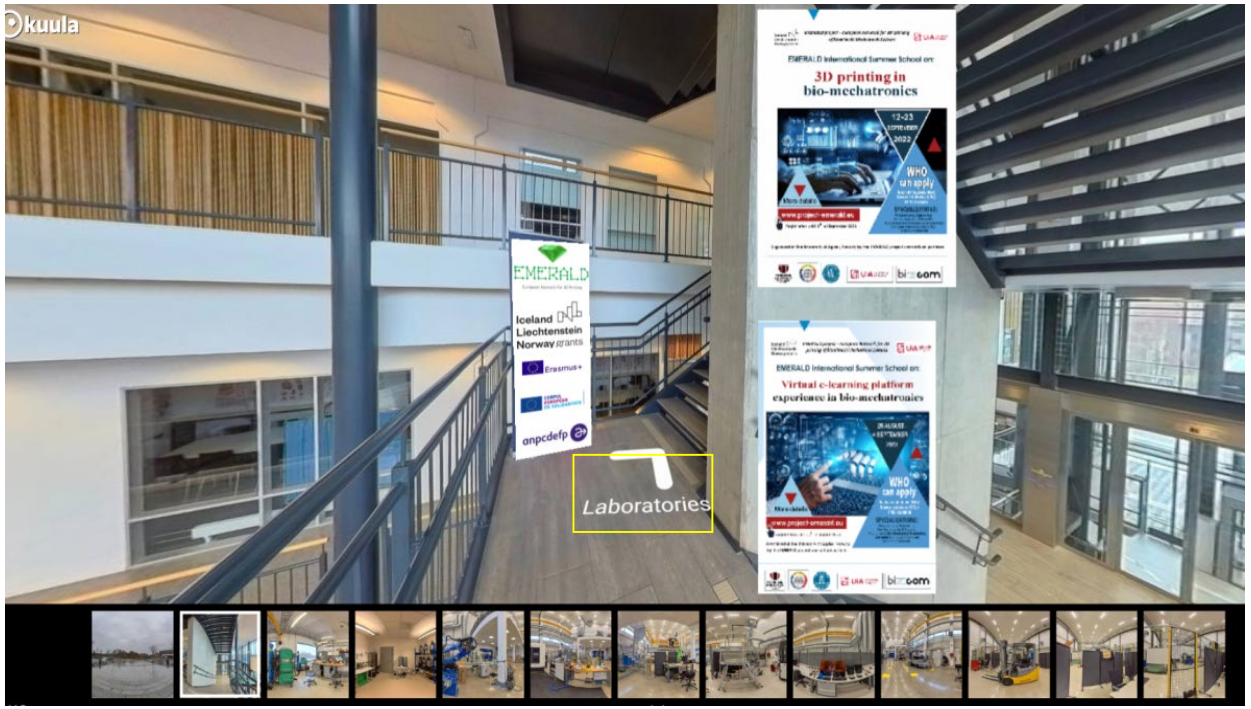
EMERALD VIRTUAL E-LEARNING PLATFORM – UiA UNIVERSITY LABORATORIES

Sensoring, Programming and Assembling virtual laboratory rooms e-learning





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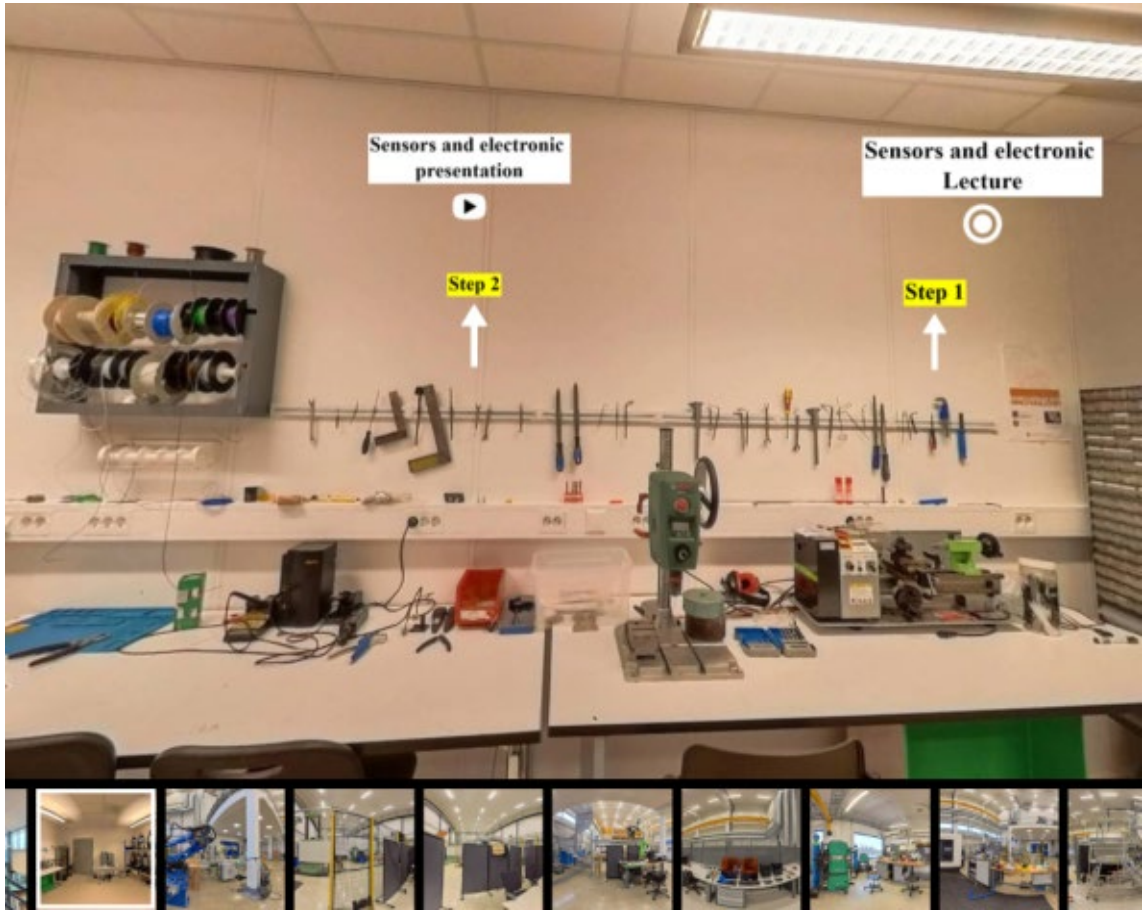

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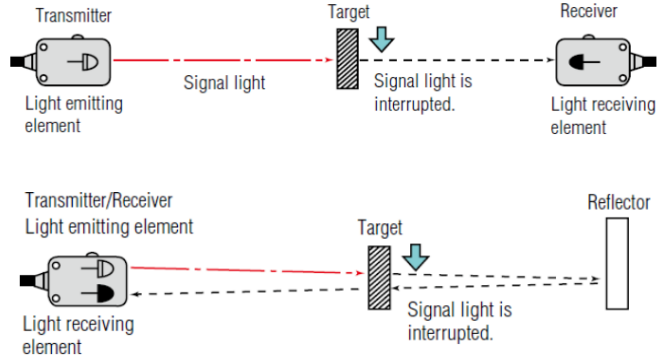
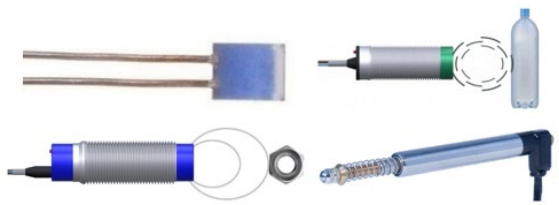
EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS

MODULE 5

Sensors and Electronics

Project Title	**European network for 3D printing of biomimetic mechatronic systems 21-COP-0019**
Output	**IO1 - EMERALD e-book for developing of biomimetic mechatronic systems**





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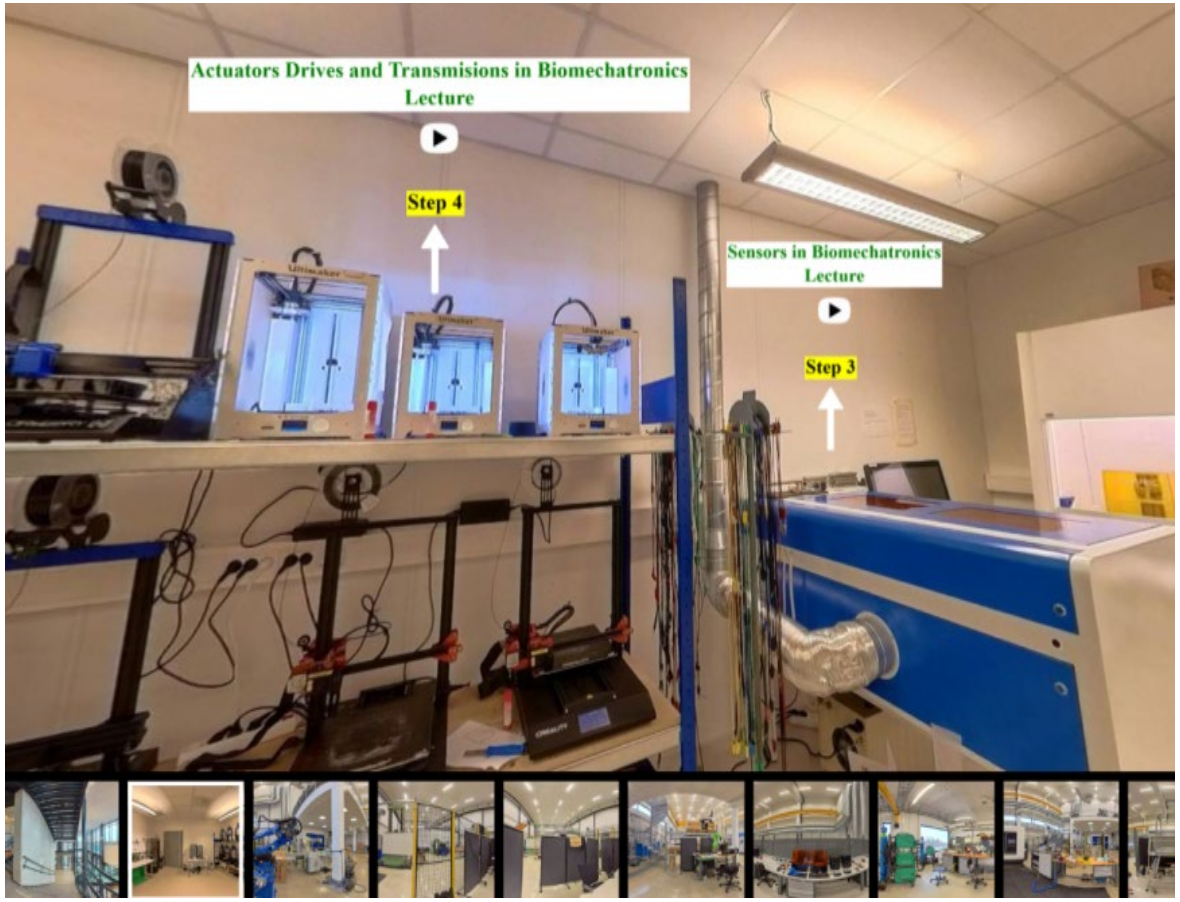

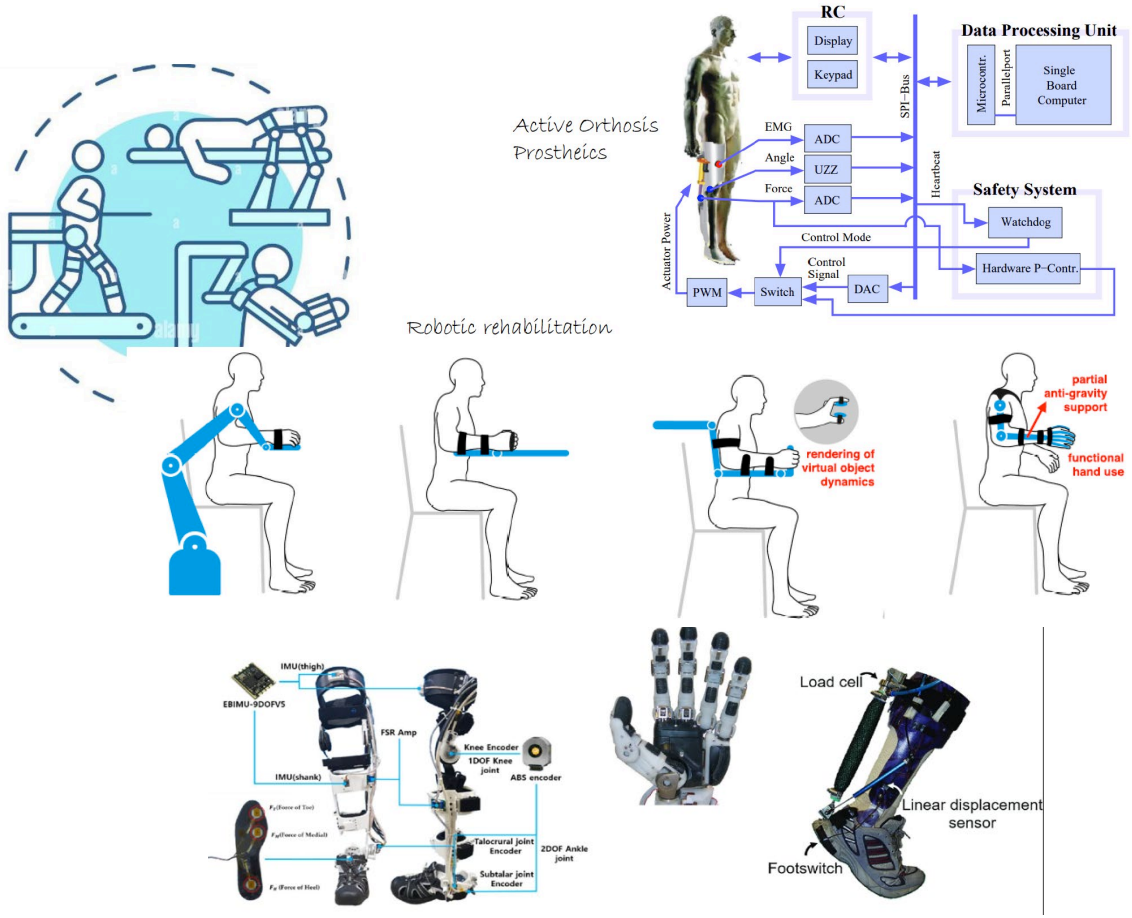

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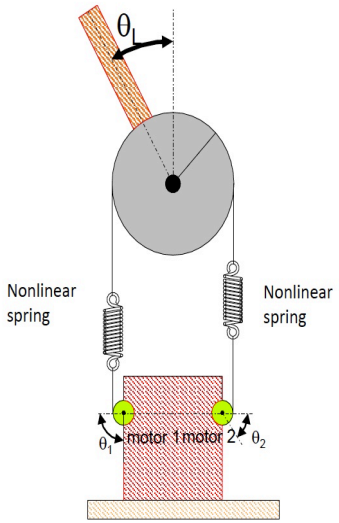
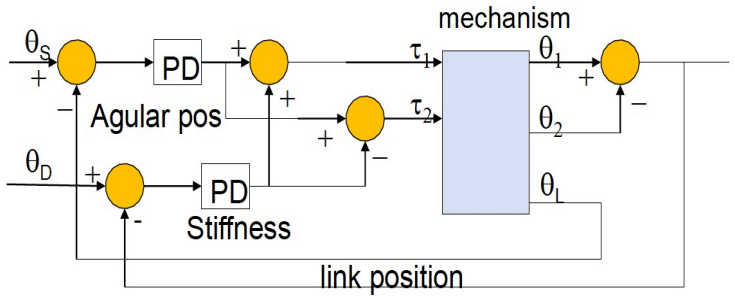
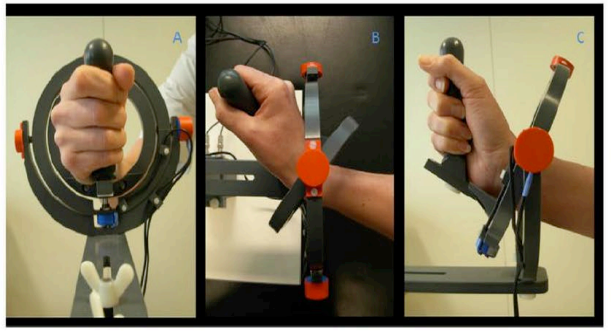




$\theta_S = (\theta_1+\theta_2)/2$ and $\theta_D = (\theta_1-\theta_2)/2$ maintaining $\theta_l = 0$



Use of variable stiffness actuators in the bio-mechatronic systems

Potentiometer as an example of measuring linear and angular position

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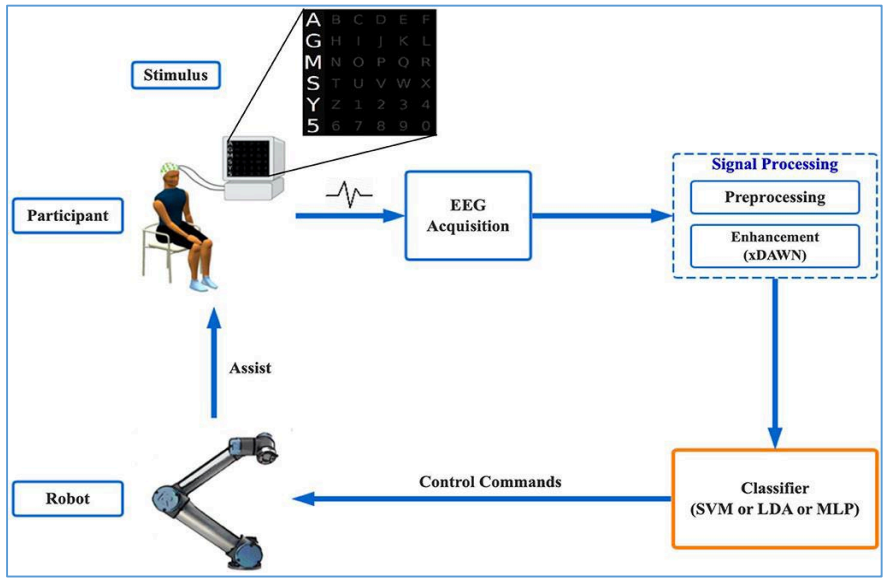
Electroencephalography (EEG) method used to measure and record the electrical activity in the brain



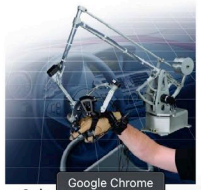
Examples of haptic technology systems


da Vinci Surgical System

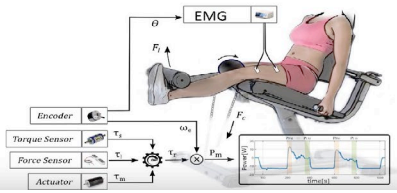

omega.6 pen-shaped force-feedback device


Motek Haptic Master VR

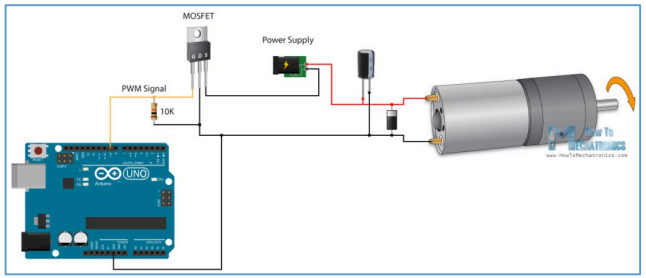

PHANToM OMNI® haptic device



CyberGlove Systems



Arduino with motor



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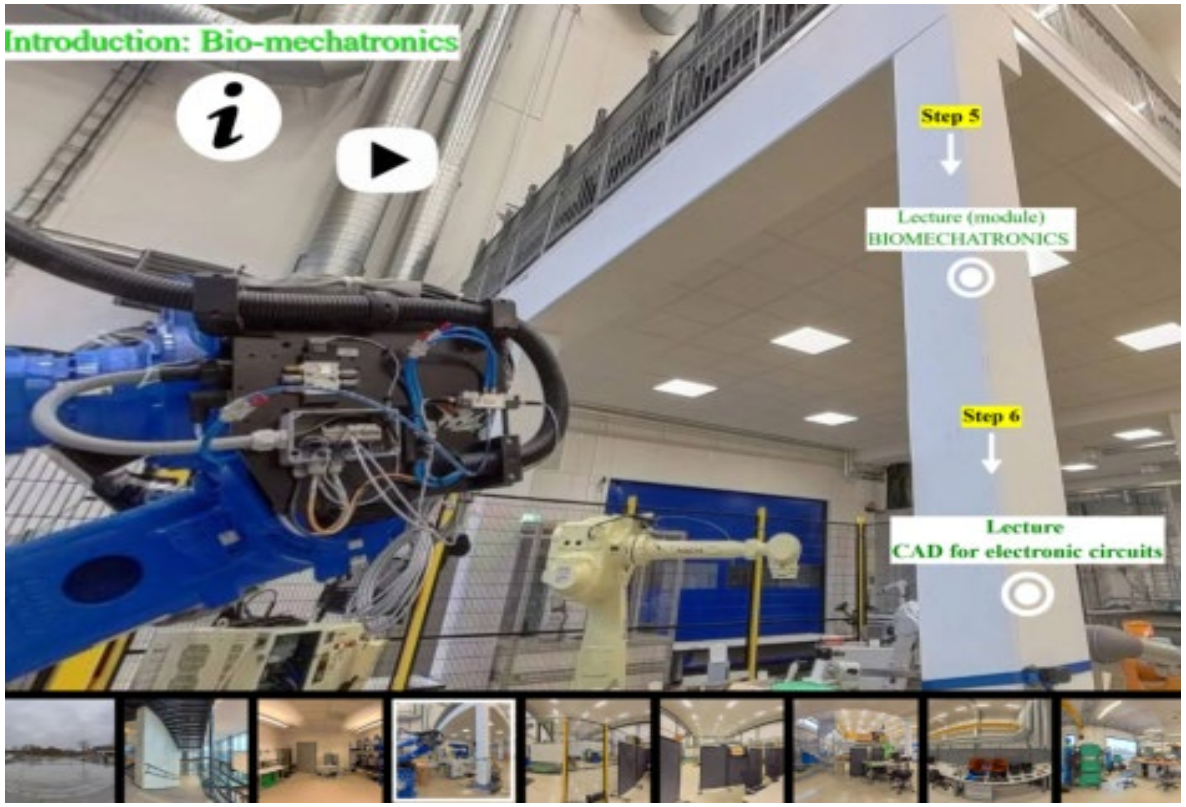

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EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS

MODULE 6.1
BIOMECHATRONICS

Project Title	**European network for 3D printing of biomimetic mechatronic systems 21-COP-0019**
Output	**IO1 - EMERALD e-book for developing of biomimetic mechatronic systems**
Module	**Module 6.1 – BIOMECHATRONICS**

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CAD DESIGN OF ELECTRONIC CIRCUITS

FOR MECHATRONIC AND MEDICAL PURPOSES

1. **Basic introduction**

Printed Circuit Board is a plate made of insulating material with electrical connections, the so-called tracks and with solder points called pads. Designed for the assembly of electronic components. Different requirements are imposed on them depending on the purpose of electronic systems, e.g. in the automotive industry, electronic systems must have high resistance to vibrations. In the case of medical applications, this may be:

- EMC compatibility,
- no harmful effects of electromagnetic fields, including those of high frequency
- use of lead-free assembly
- no use of harmful ingredients (lead)
- securing the power supply against unauthorized access,
- use of low voltages and currents flowing in the circuits.

At this point, a distinction should be made between systems that are installed directly on the patient's body (or inside) and devices that work independently, for example for medical imaging.

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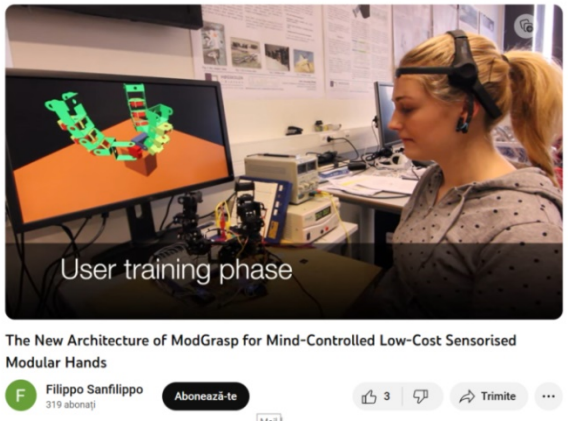
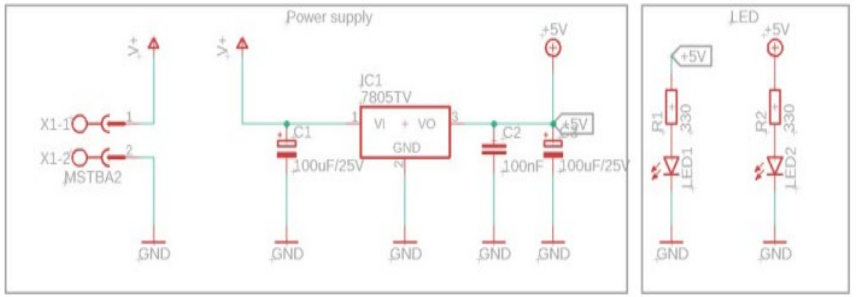
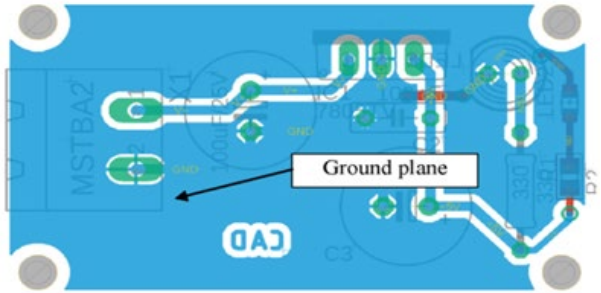
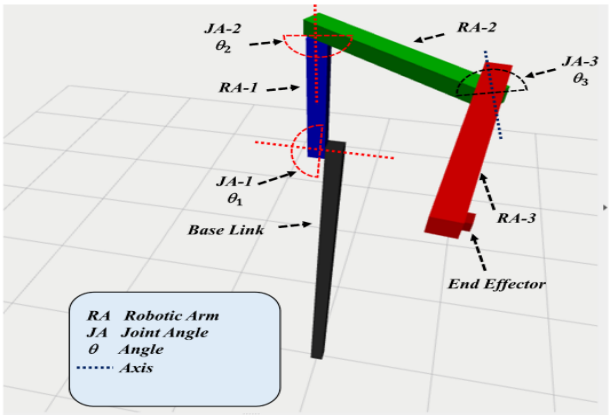


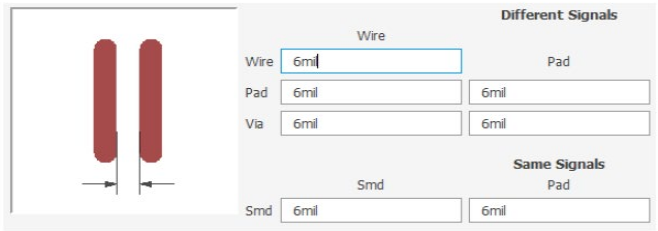
Demonstrative video on using the ModGrasp sensorized modular hands







The all in one servo lab (AIOSL) and Kinematic model of the 3-DOF manipulator



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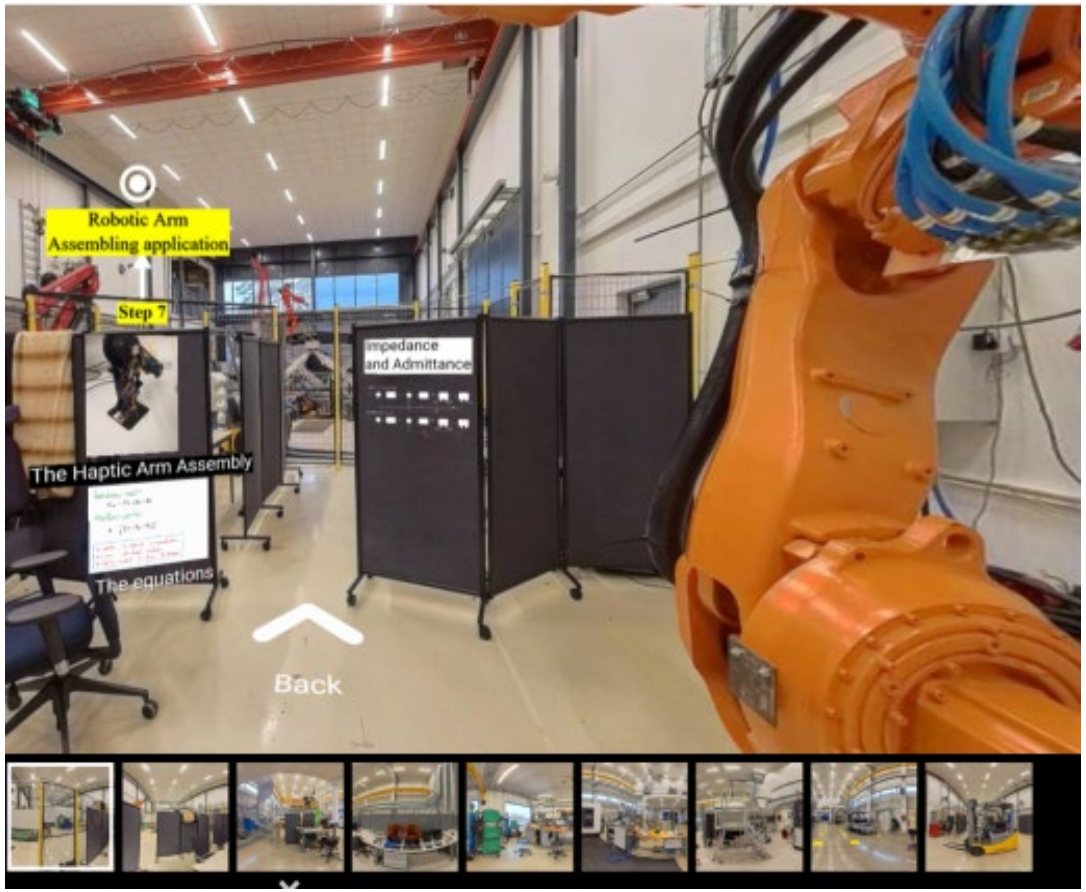
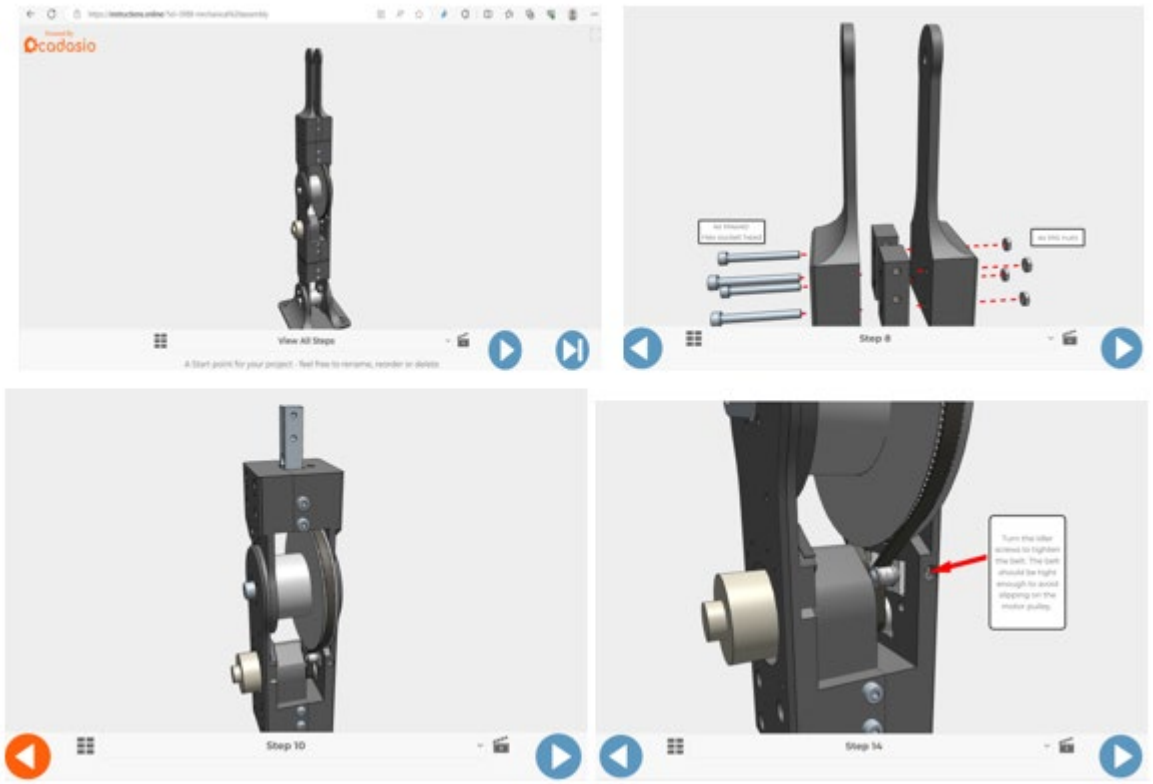


Robotic arm application



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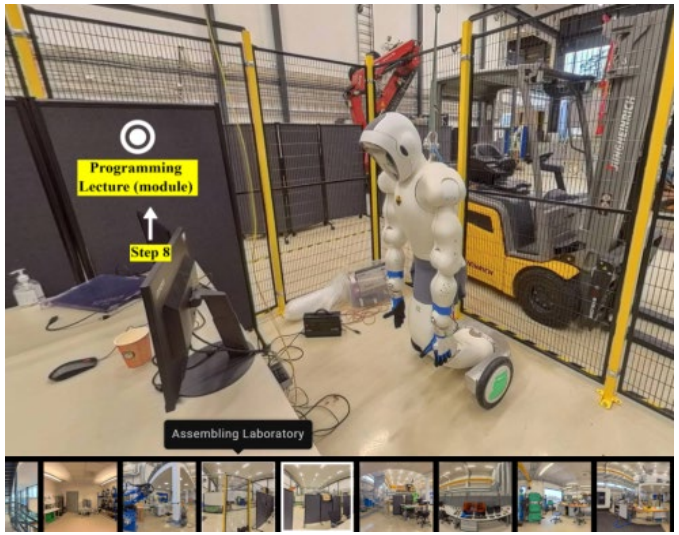

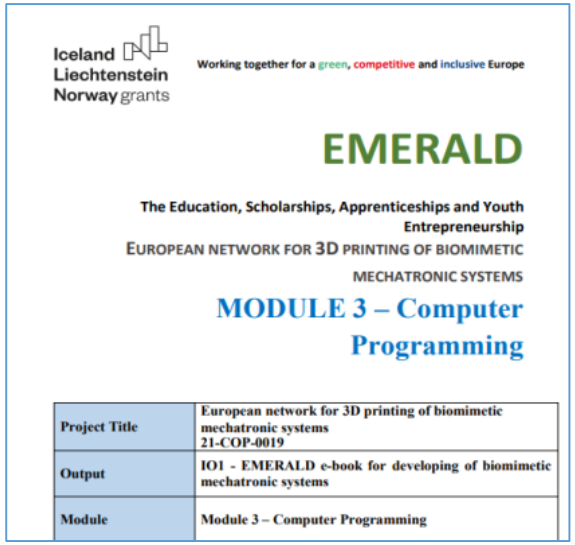
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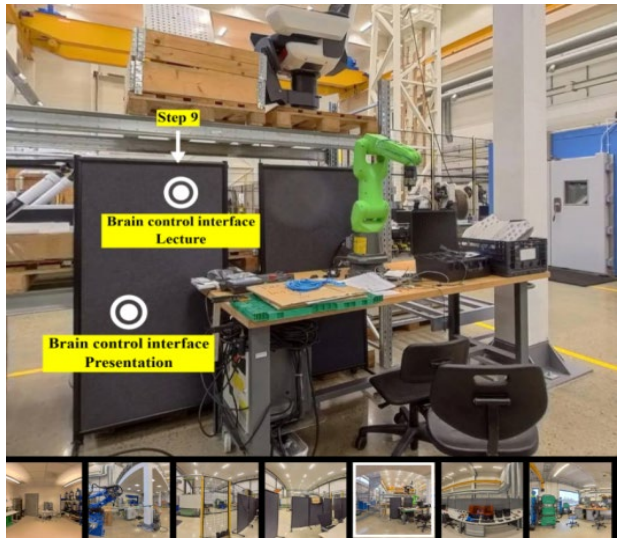
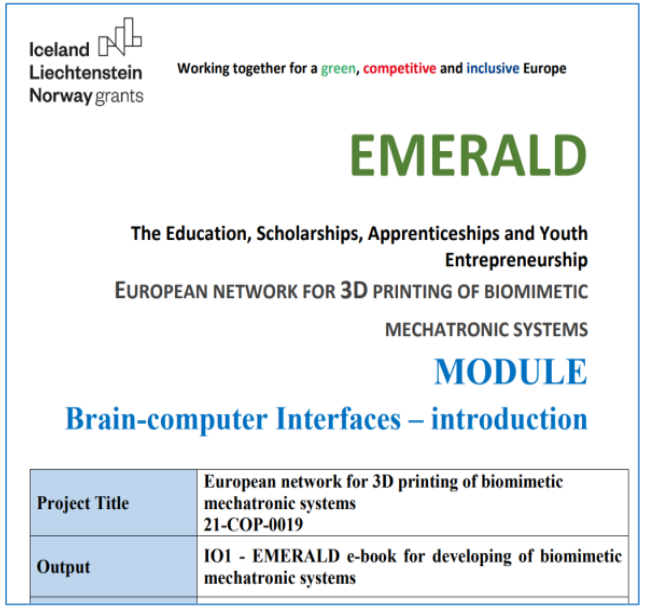
EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS

MODULE 3 – Computer Programming

Project Title	European network for 3D printing of biomimetic mechatronic systems 21-COP-0019
Output	IO1 - EMERALD e-book for developing of biomimetic mechatronic systems
Module	Module 3 – Computer Programming

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EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS

MODULE

Brain-computer Interfaces – introduction

Project Title	European network for 3D printing of biomimetic mechatronic systems 21-COP-0019
Output	IO1 - EMERALD e-book for developing of biomimetic mechatronic systems

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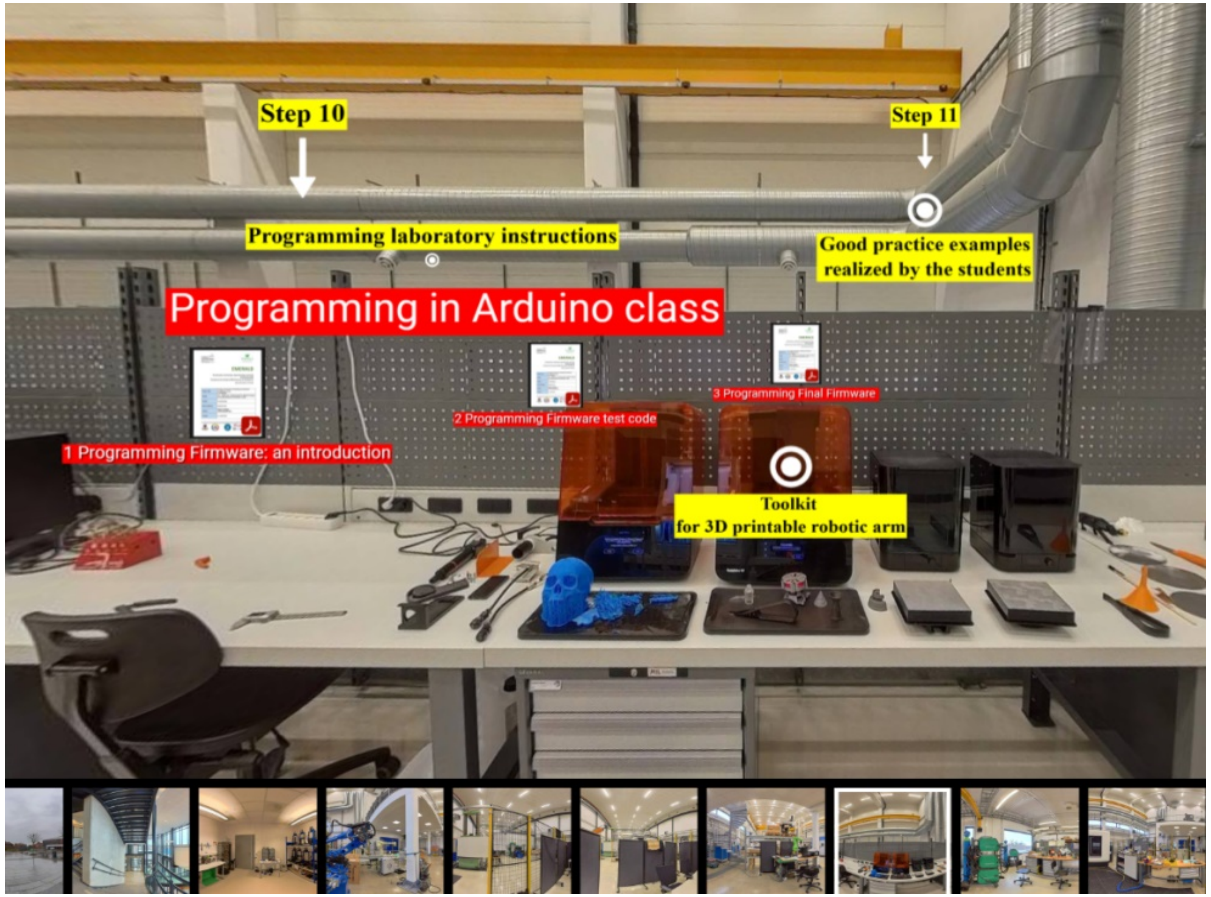
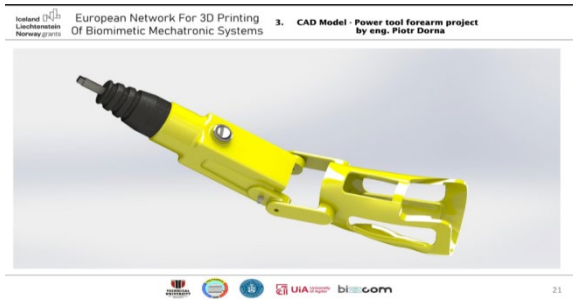


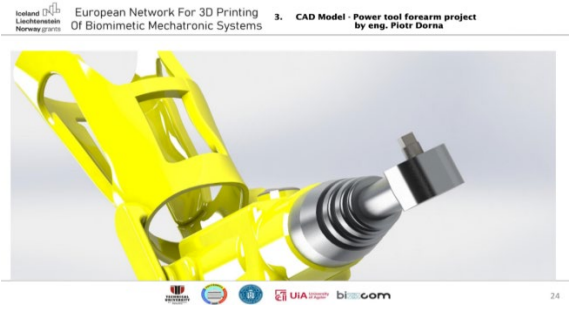
Programming firmware, writing and uploading a test code to a D1 mini microcontroller

```
#include <Arduino.h>
#include <ESP8266WiFi.h>
#include <espnow.h>
#include <Servo.h>

Servo servo_idx;   // create servo object to control a servo
Servo servo_thmb;  // create servo object to control a servo

void setup() {
    Serial.begin(115200);
    delay(1000);
    servo_idx.attach(14);  // attaches the servo on pin D5 to the servo
object
    servo_thmb.attach(12);  // attaches the servo on pin D6 to the servo
object

    WiFi.disconnect();
    ESP.eraseConfig();

    servo_idx.write(0);
    servo_thmb.write(0);
    delay(500);
    servo_idx.write(50);
    servo_thmb.write(50);
    delay(500);
    servo_idx.write(0);
    servo_thmb.write(0);

    // Wifi STA Mode
    WiFi.mode(WIFI_STA);

    // Get Mac Add
    Serial.println();
    Serial.print("Mac Address: ");
    Serial.print(WiFi.macAddress());
}

void loop() {
    // loop does nothing.
}
```

Verify and Upload!

Good practice examples of programming realized by the students using the EMERALD teaching resources of the e-learning platform





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CONCLUSIONS

The e-learning virtual laboratory room of the e-learning platform that has been assigned for sensoring, assembly, and programming, significantly enriches the educational journey in the field of bio-mechatronics by guiding the users and by stimulating them to create and work with devices like robotic arms, orthoses, and prostheses, especially for those with amputated arms. The primary goal of this laboratory is to make students (users) familiar with the entire process, starting with the basics of sensor types suitable for such systems, followed by the assembly of key components like step motors or actuators, and concluding with the necessary programming steps. To ensure a comprehensive understanding, the laboratory of Programming initially offers lectures and courses to familiarize students with fundamental terminology and concepts. This foundational knowledge is then reinforced through a series of instructional videos, applications, or toolkits, which guide users through the practical aspects of sensoring, assembling, and programming bio-mechatronic systems.

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