Project ID: 2023-1-HU01-KA210-VET-000156243

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Utilization Plan

Document Title: Utilization Plan. Integration of Technical Projects Summarizing the Erasmus Project Best Practices into Vocational Education.

I. General Objectives

1. **Deepening practical knowledge:** Students shall learn and apply **microcontrollers and PLCs**, which are the fundamental tools of industrial automation.
2. **Developing transversal competencies:** Developing hardware skills (soldering, wiring) and software skills (programming, database management) within the framework of professional subjects.
3. **Dissemination of Erasmus+ project results:** Utilizing the curriculum materials developed during the Turkey-Hungary cooperation.

II. Modules and Field Assignments

The technical projects are divided into three main pillars: Microcontrollers (MCU) and IoT, PLCs and Industrial Automation, and Robotics.

Module Name	Main Focus (Source)	Recommended Field
A. MCU basics and Heating/Cooling simulation	Microcontroller theory, I/O peripherals, Arduino/Tinkercad programming.	Electrotechnician and Industrial IT Specialist.
B. PLC and Industrial Control	PLC operation (cyclic), standard languages (Ladder Diagram, FBD), application of Zelio PLC.	Electrotechnician (primarily) and Industrial IT Specialist.
C. IoT and Database Management (Weather Station)	Network communication (HTTP POST/GET), ESP32/Wi-Fi, PHP, SQL database.	Industrial IT Specialist (primarily) and Electrotechnician.
D. Robotics and Assembly	Building a line-following robot, hardware wiring, soldering, control solutions (PIC, PLC, wired).	Electrotechnician and Industrial IT Specialist.

III. Detailed Utilization Plan by Fields

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1. Electrotechnician Classes 💡

The emphasis is on **physical control, cabling, hardware interventions**, and the most common PLC technology in the industry.

Module	Content and Utilization Method	Targeted Subjects
B. PLC and Industrial Control	**Industrial automation practice:** Familiarization with the concept of PLC (industrial computers). Understanding the PLC's **cyclic operation principle** (input sensing, program execution, output modification). **Programming practice:** Theory and practice of the most frequently used languages (Ladder Diagram, FBD, Structured Text) in Zelio Soft 2 environment in FBD mode.	Automation, Control Engineering.
D. Robotics and Assembly	**Hardware execution:** Utilizing the Line Follower robot assembly guide for soldering and assembly practices. Special attention to **component polarity** (LED, capacitor, transistor). Motor control and its setting.	Workshop Practice, Basic Electronics.
A. MCU basics	Understanding control circuits: Simulating the Arduino UNO-based Heating/Cooling project (Tinkercad). Understanding physical wiring of inputs (TMP36 sensor) and outputs (LED, LCD), and the **control logic** (e.g., heating below 18°C, cooling above 28°C).	Digital Technology, Embedded Systems.
Supplement	**PACs as the future of PLCs**, combining reliability with more advanced computer functions.	N/A.

2. Industrial IT Specialist Classes 💻

The emphasis is on **software, network communication, data management**, and the complex programming of microcontrollers.

Module	Content and Utilization Method	Targeted Subjects

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C. IoT and Database Management	**System integration and IoT:** Full processing of the Weather Station project ("Thermometer project"). **Client-side development:** Using ESP32 or Arduino UNO + ESP-01S/Ethernet Shield. Reading data from a DHT11 sensor and transmitting it via network (**HTTP POST request**). **Server-side development:** Analyzing PHP code for data reception and saving it to an SQL database. **Web visualization:** Using HTML/CSS/PHP for tabular display of data (**GET method**).	Network Knowledge, Database Management, Programming.
A. MCU basics and History	**Microcontroller theory:** History of microprocessors (Intel 4004, 8080) and explanation of the divergence between the microcontroller/microprocessor. Introduction to modern devices (Raspberry Pi Pico, Arduino, Espressif ESP32/ESP8266) suitable for IoT projects. **Programming environments:** Usage of Thonny MicroPython and Arduino IDE.	Computer Architectures, Programming.
D. Robotics and Control	**Control algorithms:** Analysis of the ROBIKA PIC line-following robot program code (written in **Assembly language**). Understanding the role of the **PWM signal** in motor control. Comparison with PLC-based ROBIKA FBD programming.	Embedded Systems Programming, Algorithmization.

IV. Suggested Methodology

1. **Theoretical introduction:** At the beginning of each module, a brief history, definition, and industrial application of the technology involved (MCU, PLC).
2. **Simulation and Design:** For the heating/cooling project, the use of the **Tinkercad simulator** is suggested before writing the code and testing the circuit. For PLC, simulation using Zelio Soft 2.
3. **Practical implementation (Electrotechnician):** Thorough execution of assembly, soldering, and wiring steps (e.g., assembling the Line Follower robot, paying attention to polarity).

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4. **Programming and Debugging (IT Specialist):** Analyzing and modifying the codes (Arduino C++, PHP) and mastering the debugging process, with special regard to network communication. Understanding the use of **AT commands** for the ESP-01S module.

V. Assessment

- **Electrotechnicians:** Creating the Zelio PLC control program (FBD) for a specified task, and professional assembly and operationalization of the robot hardware.
- **Industrial IT Specialists:** Successful reception and saving of **DHT11 sensor data to a database**, and displaying it on a website (IoT project). Demonstration of the application areas of various programming languages (C++, Assembly, FBD).