ERASMUS+ DAY 15

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Day 15: Project Presentation

Day 1: Introduction to Electronics & Components

- **Theory:**
  - Basic concepts: electric current, voltage, resistance.
  - Types of components: resistors (fixed and variable), capacitors (electrolytic, ceramic), diodes (rectifier, Zener), transistors (BJT, MOSFET).
  - Standard electronic symbols and the role of each component in a circuit.
- **Practical:**
  - Physical identification of components (reading resistor color codes, recognizing capacitor and diode polarity).
  - Basic breadboard setup and connections.
  - Basic multimeter measurements: resistance, voltage, continuity tests.

Day 2: Circuit Laws (Ohm's & Kirchhoff's Laws)

- **Theory:**
  - Ohm's Law: the relationship between voltage, current, and resistance.
  - Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).

    - Techniques for analyzing simple series, parallel, and combined circuits.
- **Practical:**
    - Simulating basic circuits using Proteus or Multisim.
    - Building circuits on breadboards and verifying Ohm's and Kirchhoff's Laws with real measurements.
    - Solving practice problems both on paper and through simulation.

Day 3: Semiconductor Basics

- **Theory:**
    - Introduction to semiconductors: conductors vs. insulators vs. semiconductors.
    - Working principle of diodes (forward and reverse bias).
    - Basic operation of BJTs and MOSFETs: switching and amplification concepts.
- **Practical:**
    - Testing diodes and transistors using a multimeter.
    - Identifying the pinout (anode, cathode, base, collector, emitter, gate, drain, source).
    - Building simple circuits using diodes (e.g., rectifier circuits) and testing their behavior.

Day 4: Digital Electronics (Logic Gates)

- **Theory:**

    - Basic digital logic: binary system and logic levels (HIGH/LOW).
    - Understanding the operation of basic gates: AND, OR, NOT, NAND, NOR.
    - Truth tables and simple Boolean expressions.
- **Practical:**
    - Simulating logic circuits using TinkerCAD (or similar platforms).
    - Building logic gate circuits on breadboards using ICs like 74HC08 (AND), 74HC32 (OR), etc.
    - Testing gate behavior with manual inputs (switches) and LEDs.

Day 5: Soldering & PCB Basics

- **Theory:**
    - Introduction to PCB design: from schematic to layout.
    - Overview of PCB manufacturing processes.
    - Good practices for soldering (temperature control, safety, technique).
- **Practical:**
    - Hands-on soldering exercises (joining wires, mounting components on protoboards).
    - Demonstration of PCB design using KiCad or Eagle (creating a simple project like an LED blinker).
    - Tips on common soldering mistakes and troubleshooting.

Day 6: Arduino/Raspberry Pi Introduction

Students are introduced to the basics of microcontrollers and microcomputers through Arduino and Raspberry Pi platforms. The “Blink LED” exercise serves as a first step in embedded systems programming, teaching core concepts like digital output, timing, and coding structure. This forms the foundation for creating more complex automated systems.

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Day 7: Sensor Interfacing

Participants learn how to connect and program different sensors like LDR (for light detection), ultrasonic sensors (for distance measurement), and IR sensors (for proximity sensing). These practical projects demonstrate how real-world information can be captured electronically, laying the groundwork for applications in robotics, security systems, and smart environments.

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Day 8: Motor Control

Focuses on controlling DC and Servo motors using the L293D motor driver. Students practice programming motors to move forward,

backward, and rotate at precise angles. Motor control is critical for building autonomous robots, CNC machines, and automated systems requiring precise movement and speed regulation.

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Day 9: Wireless Communication (IoT)

This day covers setting up wireless communication using the ESP8266 module, including Wi-Fi and Bluetooth. Students create basic IoT setups where sensors and controllers communicate data remotely. These skills are essential for building smart home devices, remote monitoring systems, and wearable technologies.

Day 10: Mini Project

Goal:

Build a basic mobile robot that moves autonomously and avoids crashing into obstacles.

How It Works:

- The robot uses an **ultrasonic sensor** (e.g., HC-SR04) to detect nearby objects.
- If an obstacle is detected within **15 cm**, the robot will:
  - **Stop**
  - **Turn** (left or right randomly or by predefined logic)

- **Continue moving forward** on a clear path.

Components Required:

- **Microcontroller:** Arduino Uno (or compatible board)
- **Sensor:** HC-SR04 ultrasonic distance sensor
- **Motor Driver:** L293D or L298N module
- **Motors:** 2x DC motors + wheels
- **Caster Wheel:** For balance and smooth turning
- **Power Supply:** 6V–12V battery pack
- **Chassis:** Frame to mount all components

Basic Robot Logic Flow:

1. Move forward continuously.
2. Continuously check the distance to obstacles.
3. If the distance is **less than 15 cm**:
    a. Stop the motors.
    b. Perform a left or right turn.
    c. Resume moving forward.

Day 11: Power Electronics

The session explains how electrical power is processed using rectifiers (AC to DC conversion) and SMPS (efficient power conversion circuits). Students learn about the importance of efficient energy use in electronics design, vital for designing power supplies for industrial systems, chargers, and consumer electronics.

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Day 12: IoT and Industry 4.0

Introduces students to the concept of Industry 4.0 and smart manufacturing through IoT-based cloud data logging. Using platforms like ThingSpeak and Blynk, students learn how real-time sensor data can be collected, visualized, and analyzed remotely. It highlights how industries use IoT to improve efficiency, maintenance, and decision-making.

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Day 13: PCB Fabrication and Troubleshooting

Students experience the process of designing and fabricating Printed Circuit Boards (PCBs), essential for professional electronic products. They also practice troubleshooting techniques to identify and repair faulty circuits. This hands-on experience is critical for careers in hardware engineering, electronics repair, and R&D.

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Day 14: Guest Lecture

An industry expert shares real-world insights about career opportunities, required skills, emerging trends, and technologies. It helps students understand how to align their technical learning with industry demands, preparing them for future careers in embedded systems, IoT, robotics, and automation.