Blended Intensive Program (BIP)

From Smart Sensors to Industrial Applications: Standards, Networks, and Integration

Applications until February 28th 2025 (call, application)

Short description:

This Blended Intensive Program (BIP) aims to bring together a diverse group of students and faculty from multiple higher education institutions (HEIs) to engage in a transdisciplinary and international learning experience focused on smart sensors technologies and industrial applications. This BIP will emphasize the use of industrial standards and real-world sensor networks in various industrial contexts, providing an opportunity to develop new skills, tackle societal challenges, and enhance long-term mobility prospects for students.

Organizing board:

Host university UBI – Portugal (Universidade da Beira Interior)	Partner 1 UNIBS - Italy University of Brescia	Partner 2 UNISA – Italy University of Salerno	Partner 3 UNIVG - Spain University of Vigo
Partner 4 UNIZG – Spain University of Zaragoza			

No. of ECTS issued: 3

Activity: 2 weeks online (asynchronous and synchronous learning) 60h, 1 week presential (hands-on labs, workshops, industry visits) 30h.

Transnational participation: University of Beira Interior (UBI) – Portugal, University of Brescia (UNIBS)– Italy, University of Salerno (UNISA) – Italy, University of Vigo (UNIVG) – Spain, University of Zaragoza (UNIZG) – Spain.

Objectives

This program provides specialized content focusing on the integration of smart sensor technologies into industrial applications using widely recognized industrial standards.

The BIP will:

- Leverage the expertise of faculty members in digital networks for industrial communications and wireless fieldbus technologies to enhance learning outcomes and ensure industry relevance.

- Incorporate knowledge on the implementation of complex processing and control algorithms in FPGAs, allowing students to explore advanced sensor integration techniques and real-time data processing for industrial applications.

- Encourage challenge-based learning with international, transdisciplinary teams.

- Develop competencies in sensor network design, industrial standards, and real-world applications.

- Facilitate exchange of teaching practices and innovative approaches between faculty from different institutions.

- Address societal challenges, such as energy efficiency and automation in smart industries.

3. Structure and Content:

A. Online Component (2 weeks):

Introduction to Sensors and Industrial Applications

- Overview of sensor types (temperature, pressure, proximity sensors, etc.).
- Industrial use cases for sensors: manufacturing, automation, predictive maintenance.
- Signal conditioning, analogue-to-digital conversion, and integration.

Sensor Networks and Industrial Internet of Things

- Wireless and wired sensor networks: basic architectures (mesh, star, point-to-point).
- Interface technologies for sensor systems in industrial contexts.
- Best practices for integrating sensors into automated control systems.

Industrial Standards and Interoperability

- Overview of key industrial standards for sensor integration and communication.
- The role of standards in ensuring interoperability among sensor systems and industrial applications.
- Best practices for implementing standard-compliant sensor networks.

Industrial Applications

- Data collection and processing from sensors.
- Sensor systems in industrial monitoring and control systems.
- Design principles for real-time monitoring systems in industrial environments.

Advanced Sensor Systems

- Focus on FPGA Implementation: An introduction to the implementation of complex processing and control algorithms in FPGAs, showcasing their application in sensor integration and data processing.

B. Physical Mobility Component (1 week) (25h)

The physical mobility week will be held at a University of Beira Interior and will focus on hands-on practical training, group collaboration, and site visits to industrial partners. Students will work in multinational teams, engaging in transdisciplinary projects that bridge the gap between sensor technology and industrial applications.

Day 1: Welcome and Program Overview

Activities: (6h)

- Orientation and program introduction.
- Ice-breaker and team formation activities.
- Keynote lecture on the future of sensors in industrial automation and the importance of digital networks for industrial communications.
- Guest lecture on FPGA applications in industrial systems by a faculty expert.
- Guided lab tour showcasing sensor integration in smart industry environments.

Day 2: Hands-on Lab: Sensor Network Setup and Configuration

Content:

- Building and configuring a basic sensor network for industrial applications.
- Data capture and integration with industrial control systems.

Activities: (6h)

- Practical lab session on setting up standard-compliant sensor networks.
- Troubleshooting and testing real-time data transmission.

Day 3: Implementing Industrial Standards and FPGA Applications

Content:

- Hands-on work on standard-compliant sensor networks.
- Standards-based configuration for interoperability.
- FPGA implementation of complex processing algorithms for sensor data analysis.

Activities: (6h)

- Guest speaker session: Industry expert on the role of standards in smart industries. (0.5h) (TBD)
- Workshop on sensor system configuration for industrial automation led by faculty experts. (1h)
- Group projects focusing on real-world sensor applications and systems integration, with an emphasis on FPGA solutions. (4.5h)

Day 4: Industry Visit and Group Project Work

Activities: (6h)

- Field visit to an industrial partner implementing sensor-based solutions in a manufacturing or automation setting.
- Group project: Integrating sensors into a real-world industrial system, applying standards and best practices while utilizing FPGA technology.
- Team consultations and feedback from industry mentors.

Day 5: Final Presentations and Feedback

Activities: 6h

- Final assessment: quizzes and project evaluations.
- Online submission and presentations of group project reports
- Peer feedback and evaluation.
- Individual reflection on learning outcomes.
- Panel discussion with academic and industry experts
- Peer review and feedback sessions.
- Closing ceremony and certificate distribution.

5. Assessment and Evaluation

- Online Component (30%): Participation in virtual labs, quizzes, and discussions.
- Hands-on Lab Work (40%): Group project performance and practical lab work during the mobility week.
- Final Project and Report (30%): Group presentation, written report, peer review, and final reflections.