UNIVERSITÄT SIEGEN

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Erasmus+ SkoPS

<Course Plan Template (General structure of courses)>

Project Title	Empowering the European Workforce Development through Online/Virtual Skills Training for Digital Transformation towards Mitigating the Impact of Pandemic Situations (SkoPS)		
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Disclaimer

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1 Introduction

The Course Plan Template can help the partners to prepare the course materials that helps us to organize the materials and contents of courses in the SkoPS project in common form. There are also some other Forms and templates for the Student's assessment Plan and Evaluation Questionaries Plan for each Course that can be also added to this Template.

1.1 Abstract

The methodology in creating the SkoPS courses will be as follows: Each partner is mainly responsible for preparing their own materials. All other partners and reviewers based on the table of reviewers in the project management handbook will review the prepared materials and will provide feedback in order to improve the quality of the materials. A recurring review process with all partners involved will further enhance the quality of the courses. Right at the beginning of the project (directly after the kick-off meeting), a requirement analysis will be carried out by all project partners in order to precise the content of the courses which are outlined in this proposal. A second meeting will be conducted six months after the kick-off meeting as an internal course development Hackathon. Each partner will invite one or two external experts for this Hackathon to get their feedback for improving the quality of the course. To ensure the quality and to narrow down the courses to the requirements of the industry, SkoPS will create an advisory board with experts from industry and research. Each partner will invite at least one expert to the scientific advisory board. Furthermore, the scientific advisory board will provide guidelines for the course materials.

1.2 Purpose of the document

The purpose of this document is having the same template for all courses. In this Template for each course some features are considered.

1.3 Relation to other deliverables

This Report is part of the D0.18 which is General structure of each course.

2 Template

Course Plan Template			
Course ID and Title:	08- Wireless sensor networks		
Course Duration:	45h	**Course ECTS:**	1.5
Leading Organization:	UA		
Course Media:	Text, videos		
Laboratory (Yes/No)	Yes		
Course Description:			

This module provides the theoretical and practical background for wireless sensor network (WSN) in the Internet of things (IoT). WSN is a significant element in the IoT paradigm. This module is designed to prepare students in the field of computer science to taking up WSN industrial related task. Participating student receive an understanding of Sensing as a component of intelligent wireless systems, the internet of things and its applications, Wireless communication standards, introduction to basic wireless embedded systems, WSN operating systems and routing protocols, Power requirement and compensation techniques for WSN, data handling, and the security considerations for WSN. The primary focus is to bridge the gap between IoT applications/ application development and its implementation on embedded devices for computer science students. The IoT paradigm extends beyond a simple application design; it encompasses the communication systems between nodes, the communicating embedded devices (sensors and nodes), and a data handling unit. In recent technology trends, which foresees a future of industries indulging in the use of IoT and Artificial intelligence to evolve, students with computer science background need an adequate understanding of IoT development.

Intended Module Learning Outcomes and Qualification goals

On completion of this module students should be able to:

1. Classify real-world IoT design constraints such as engineering decisions that are based on power-constrained hardware.
2. Explore Object-oriented programming concept in creating a design for programming WSN – IoT application.
    a. Implement ad hoc wireless network services and understand the implications of networking design choice on overall system performance and reliability;
    b. Critically evaluate a WSN-IoT application.

The fulfillment of the learning outcome will be through lectures and virtual lab sessions. The lab session shall provide a hands-on understanding of IoT operations and its WSN components. Several examples of IoT will be brought forth during lectures, and their design explained.

Course Materials and Equipment (Prerequisite)

- *Azure service account: Students need a credit card number to access their Azure account, but no fee will be deducted from their account. With an azure account, they will be able to access Azure services for one year*
- A computer connected to the Internet
- Headphones and microphone

Teaching and Learning Activities:

The teaching and learning activities include:

- Forums
- Quizzes
- Reading material
- Educational videos
- Virtual lab sessions

Course activities:

The course includes different types of activities:

- Participating in forums
- Reading materials
- Watching educational videos
- Carrying out lab assignments
- Answering quizzes with questions raised from the descriptive text.

Course Objectives:

The primary focus of the course is to bridge the gap between IoT applications/ application development and its implementation on embedded devices for computer science students.

Course Summary:

The course includes four theoretical chapters and three virtual labs.

Table of Contents:

- Iot Introduction.
  - Meaning of Iot.
  - Principal concepts inside the world of Iot.
  - Rising markets within the Iot.

- Devices and sensors
  - Translating physical quantities into electrical signals.
    - Analog and digital signals.
    - Resolution, sampling rate.
  - Wireless Vs Wired solutions.
  - Principal wireless families present in the market.
    - Wi-fi
    - Bluetooth
    - RFID
    - IEEE 802.15.4 Mesh
    - 3G, 4G/LTE, 5G
    - LPWAN
  - Devices
    - System on a chip.
    - Single Board Computer.
    - Arduino and ESP8266 as a rapid prototyping
    - Iot bridges.

- Programming challenges (https://www.tinkercad.com/ and Arduino board)
  - The Arduino platform
  - Arduino an overview.
  - Arduino a big family.
  - Arduino shields.
  - Ardunio IDE
  - Our firs sketch
  - Using libraries.
  - Connect things to the cloud.

- Azure and IoT
  - A brief history about cloud computing
  - Azure introduction (Portal, ARM, CLI & Cloud Shell, governance, expenses, etc)
  - Exercise: create your first hello world app in Azure
  - Azure and IoT:
  - IoT Hub vs IoT Central
  - Communication (SDKs, REST, events, messages, etc)
  - Example of solutions
  - Deployment practices for Azure & IoT

- Quizz

- Lab 1: People identification
  - Part 1:
    - Create resources in Azure (Resource Group, Storage, Azure Function, Cognitive Service, Iot Hub)
    - Setup resources
    - Create C# program to analyze the picture
    - Deployment into Azure
    - Upload some pictures to test the scenario
  - Part 2: (with IoT device)
    - Setup your device with Iot Hub
    - Create a program to send data to Azure
    - Capture data and see the results
    - Cleanup resources

- Lab 2: Real time data.
  - Create resources in Azure (Resource Group, Storage, Cosmos DB, Azure Function)
  - Setup resources
  - Use telemetry simulator for sending data
  - Deployment into Azure Function
  - Run telemetry to ingest some data
  - Setup PowerBI with some dashboard
  - Run again telemetry to see real time
  - Cleanup resources

- Lab 3: Data exploration with anomaly detection
  - Create resources in Azure (Resource Group, Storage, Databricks, Cognitive Services)
  - Setup resources
  - Setup databricks
  - Use telemetry simulator for sending data
  - Run telemetry to ingest some data
  - Notebook to prepare and detect anomalies
  - Cleanup resources

Laboratory Description and Equipment:

Course References:

Evaluation and Assessment Methods:

- Quizzes (self-assessment) **- Collaborative assessment of virtual labs (peer or self assessment, depending on the synchronous/asynchronous nature of the course)**
The tasks lead to the production of the intellectual output and the applied methodology.

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