SMACITE

Enhancing skills for smart city tech

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Boosting the technical and non-technical skills and competences of smart cities technicians and engineers

WP3: Learning resources for the upskilling/reskilling of Smart Cities technicians and engineers

D3.1 Learning resources for Smart Cities key enabling technologies

Final Version

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DELIVERABLE FACTSHEET

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DELIVERABLE HISTORY

Version	Name	Partner	Date	Comments
0.1	Maria Rigou, Vasileios Gkamas	UPATRAS	10/01/2025	Draft for review
0.2	Vera Pospelova, Ivayulo Gueorguiev	UAH ESI CEE	20/01/2025	Reviewed edition
1.0	Maria Rigou, Vasileios Gkamas	UPATRAS	29/01/2025	Final edition

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PROJECT SUMMARY

The project aims to address the skills gap of Smart Cities technicians and engineers, by designing and testing a vocational education and training program that is based on a novel and multi-disciplinary curriculum combining digital skills on Smart Cities enabling technologies, with soft, entrepreneurship and green skills.

The expected project outputs are:

- A Smart Cities competences map and ESCO-compliant Smart Cities job profiles.
- A Smart Cities curriculum combining both technical and non-technical skills and competences and promoting personalized learning pathways.
- Learning resources for Smart Cities enabling technologies and for building the soft, entrepreneurship and green skills of Smart Cities technicians and Engineers.
- A diagnostic tool to identify personalized learning pathways.
- A MOOC for Smart Cities enabling technologies.
- Virtual Worlds for building the soft, green and entrepreneurship skills of Smart Cities technicians and engineers.

The main project beneficiaries are Smart Cities technician and engineers either from the public sector (i.e. municipalities) or enterprises providing Smart Cities solutions, as well as HEI and VET students interested in Smart Cities.

The curriculum will be tested through 4 national pilots in Greece, Bulgaria, Spain and Italy with at least 160 trainees. The certification of the skills and competences will follow a two-fold approach: (a) using micro-credentials to recognize the knowledge and skills gained through the successful completion of each online training module at the MOOC and Virtual Worlds and (b) designing the “Smart Cities Specialization Certification” that will be awarded to those passing online certifications exams with e-proctoring after the completion of the training modules.

The project will create an ecosystem for the co-design and co-development of an innovative curriculum and technology-enhanced learning tools for the upskilling/reskilling of Smart Cities technicians and engineers.

1 Introduction

This deliverable is a set of Open Educational Resources in the format of texts, short videos, and presentations for Smart Cities key enabling technologies.

1.1 Structure of the deliverable

The deliverable is divided into 2 main sections.

- **Section 1** introduces the deliverable. More specifically, Section 1.1 describes the structure of the deliverable, Section 1.2 outlines the target audience and finally Section 1.3 outlines the dependencies with other WPs and deliverables.
- **Section 2** describes the set of the developed Open Educational Resources.

1.2 Target audience

The target audience of the deliverable includes the following stakeholders:

- The SMACITE granting authority.
- The SMACITE participating organizations (the project coordinator and the project
- partners).
- The SMACITE project stakeholders.
- Educators and trainers in the field of Smart Cities.
- Learners (i.e Smart Cities Engineers and Technicians) interested in building their skills on Smart Cities enabling technologies.

1.3 Dependencies with other WPs and deliverables

The deliverable D3.1 has direct connections with the following WPs and deliverables:

- **D2.2 The SMACITE curriculum for Smart Cities** of WP2: this deliverable describes the SMACITE curriculum.
- **D4.2 MOOC for Smart Cities** of WP4: this deliverable describes the SMACITE MOOC.

2 Open Educational Resources for Smart Cites key enabling technologies

The set of the Open Educational Resources developed for Smart Cities key enabling technologies is available at this **link**.

It includes the learning resources of the following courses.

2.1 Smart Cites (developed by CDM)

This course covers in depth concepts related to the planning, design and implementation of Smart Cities related projects. We start by covering the work that has already been done in this area: standards and specifications within the context of Smart Cities that allow us to understand the state of the art and proceed into specific well-known examples of smart cities initiatives like CO2 reduction, public transportation modernization, waste management and IoT usage. In the last unit we cover a guide designed by the EIP-SCC for Smart Cities project implementation.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction to the Concept of Smart Cities
- Module 2: Case of Success
- Module 3: Technological Solutions for Smart Cities
- Module 4: Planning and Deployment of Smart Cities Solutions

2.2 Internet of Things (developed by UPATRAS)

This course deals with the Internet of Things (IoT) technology. It presents the key concepts and technologies employed by IoT together with applications of IoT in Smart Cities. Emphasis is placed on the architecture and different components of IoT devices, the communication technologies employed by the IoT, and the integration between IoT and cloud computing.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction to IoT
- Module 2: IoT Devices
- Module 3: IoT Communications
- Module 4: IoT Cloud

2.3 Cybersecurity (developed by TXORIERRI)

This course deals with the Cybersecurity in Smart Cities. It presents the key concepts and technologies employed to secure digital systems in Smart Cities. Emphasis is placed on a) measures used to enhance cybersecurity, b) technologies used to improve cybersecurity, and c) control and monitoring technologies.

The learning resources cover the following 6 modules of the course:

- Module 1: Introduction to Cybersecurity in Smart Cities
- Module 2: Cyberthreats and Attacks
- Module 3: Cybersecurity Measures
- Module 4: Cybersecurity Tools and Techniques
- Module 5: Monitoring a Smart City
- Module 6: Risk Management

2.4 Cloud computing (developed by CDM)

This course covers in a certain level of depth how cloud computing services can be used for daily projects. We talk about the infrastructure that supports cloud computing providers, the low-level service functionality that provides basic things like housing and hosting, and the software as a service (SaaS) that we can consume from cloud providers. Some focus is placed on how to embrace cloud migration projects and typical hurdles that we may find in these efforts. In the last unit we talk about current trends in cloud computing like neural networks and practical applications as seen, for example, in large language models.

The learning resources cover the following 6 modules of the course:

- Module 1: Introduction to Cloud Computing
- Module 2: Cloud Computing Infrastructure
- Module 3: Deployment of Cloud Computing solutions
- Module 4: Hyperscalers: Amazon Web Services, Microsoft Azure, and Google Cloud Platform,
- Module 5: Introduction to software development and deployment for Cloud Computing
- Module 6: New technologies applied to Cloud Computing

2.5 Data analytics and visualizations (developed by UPATRAS)

This course provides an overview of Data Analytics and Visualizations (DAV) concepts, methodologies, techniques and use cases oriented in Smart Cities (SCs). The course helps students gain the necessary knowledge to integrate advanced data analytics techniques and well-established data visualization principles into SCs applications along with complementary technological paradigms such as Cloud Computing, Internet of Things (IoT) and Augmented/Mixed Reality.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction to Data Analytics and Data Visualization
- Module 2: Data Analytics for Smart Cities
- Module 3: Data Visualization for Smart Cities
- Module 4: Smart Cities Use Cases

2.6 Machine Learning with Big Data (developed by UPATRAS)

This course is about Machine Learning (ML) techniques focusing on the Smart Cities domain of applications, a domain that often generates and handles Big Data. It presents the main principles and applications of ML and its relation to IR (Information Retrieval), Data Mining, and Statistics. Emphasis is placed on a) how we can practically apply ML and what to consider when choosing an ML technique, b) presenting examples of applying ML to various Smart Cities domains (transportation, government, industry, etc.), and c) how ML can be integrated with technologies like IoT and cloud infrastructures.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction to Machine Learning and Big Data
- Module 2: Machine Learning for Smart Cities
- Module 3: Machine Learning Case Studies for Smart Cities
- Module 4: Machine Learning, IoT, and Cloud Computing

2.7 3D printing (developed by UNIWA)

The purpose of this course is to provide an overview of 3D Design, Modeling and Printing, as well as its uses in the context of smart cities.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction to 3D Technologies
- Module 2: 3D design
- Module 3: 3D Printing
- Module 4: Applications of 3D printing in Smart cities

2.8 Blockchain (developed by UNIWA)

This comprehensive course provides a deep dive into blockchain technologies, their architecture, applications, and real-world use cases. Students gain a profound understanding of blockchain fundamentals, smart contracts, cryptography, web development for blockchain, and programming techniques. The course also explores the governance and innovative applications of blockchain in various industries.

The learning resources cover the following 8 modules of the course:

- Module 1: Blockchain Architecture
- Module 2: Blockchain Technology
- Module 3: Cryptography
- Module 4: Data Structures in Blockchain
- Module 5: Smart Contracts
- Module 6: Web Development
- Module 7: Programming for Blockchain
- Module 8: Blockchain Applications for Smart Cities

2.9 Drones (developed by UNIWA)

This course provides an in-depth exploration of the role of Unmanned Aerial Vehicles (UAVs) in the context of smart cities. With the rapid advancement of UAV technology and the growing emphasis on urban development, understanding the applications, challenges, and opportunities of UAVs in smart city initiatives is crucial. This course cover a range of topics including UAV technology, regulations, data acquisition and analysis, and practical applications in various domains within smart cities such as infrastructure monitoring, public safety, environmental management, and urban planning.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction, Historical Review and Types of UAVs
- Module 2: Drone Technology
- Module 3: Drone Applications
- Module 4: Drone Applications in Smart Cities

2.10 Autonomous Vehicles (developed by UNIWA)

This course provides an in-depth exploration of autonomous vehicles (AVs) within the context of smart cities. It covers the technological, social, economic, and policy aspects related to the integration of AVs into urban environments. Students will gain a comprehensive understanding of the challenges and opportunities presented by AVs in reshaping transportation systems and urban landscapes.

The learning resources cover the following 4 modules of the course:

- Module 1: Introduction and historical review to Autonomous Cars (Week 1)
- Module 2: Technology of Autonomous Cars (Week 2)
- Module 3: Requirements of Autonomous Vehicles (Week 3)
- Module 4: Open Challenges

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