IoT4SMEs
INTERNET OF THINGS FOR EUROPEAN SMALL AND MEDIUM ENTERPRISES

Erasmus+

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INTERNET OF THINGS FOR EUROPEAN SMALL AND MEDIUM ENTERPRISES

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IoT4SMEs Qualifications
Short Description

Document Metadata

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March 2017	First structure of the IoT4SMEs qualifications
July 2017	Final version of short description of the IoT4SMEs qualifications – English version.

Title	IoT Decision Maker
Label	
Areas of activity	The holder of "IoT Decision Maker" certification could work in the following business areas: • IoT Consultant; • Junior IoT Administrator.
Organizational Contexts	In SMEs implementing/offering IoT services In SMEs acting in different economic sectors
Organizational Roles	Basic analysis of existing IoT service in relation with company's needs; support the implementation of IoT services within the company; understand the business impact of the IoT technologies on SMEs organizations, either from a brand, product or service perspective and from a data analysis perspective; support in identifying clients' needs, implementing IoT services, monitoring service and applications' delivery; manage feedback received from clients; support the implementation of data analysis techniques; identify key legal aspects related to IoT: privacy, personal information protection and data protection, patents; monitor the correct implementation of networking and communication protocols.
Core Competence Units	1. Introduction to IoT technology; 2. IoT business strategy; 3. Overview of data analysis; 4. Legal aspects; 5. Basics of networking and security
Units overview	**1. Introduction to IoT Technology:** Students are expected to demonstrate theoretical knowledge/skills and competences on IoT: terms and basic concepts; main application sectors; basics of hardware components (microcontrollers and microprocessors, sensors, actuators); basics of

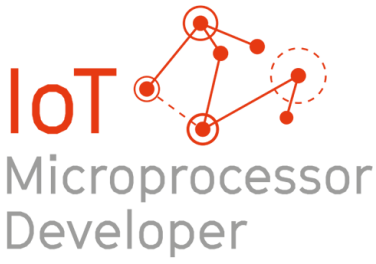
	communication technologies and platforms; commonalities and differences between IoT and other technologies (e.g. Cloud computing, Big Data, Industry 4.0); IoT national and international policies. **2. IoT business strategy:** Students are expected to have factual knowledge, skills and competences of: features of product and services interconnected; IoT benefits and challenges; new business opportunities and competitive risks; IoT business solutions main features; IoT Solutions from user, business, operational, revenue and cost perspectives; introduction of IoT into business: i. strategy and alignment; ii. organization iii. budgeting iv. product development v. manufacturing vi. distribution vii. customer satisfaction viii. IoT solution; ix. creation of successful IoT business for SMEs (how to implement an IoT business). **3. Overview of data analysis:** Students are expected to have an overview of: terms and basic concepts of IoT data analysis; IoT Ecosystem for data acquisition, filtering, transmission & analysis; Architecture of IoT-systems; data processing approaches; introduction to: pattern recognition, data-mining techniques, AI-methods for data analysis; opportunities for predictive analytics; IoT data processing approaches: introduction to cloud and fog computing; role of big data, cloud computing and data analytics in IoT system; industrial examples. **4. Legal aspects:** Students are expected to demonstrate sound knowledge/skills and competences on: basic of legal informatics; privacy and personal information protection; new EU regulation on data protection; patents on IoT hardware and software; IoT standardization; liabilities and damages connected to IoT technologies

	5. Basics of networking and security At the end of this unit the student is expected to demonstrate a theoretical knowledge, skills and competences on: networking and communication protocols for IoT environments; risk analysis in IoT environments: i. basics of IoT security; ii. hardware and software vulnerabilities; iii. security risks connected to the implementation of networking and communication protocols.
PRE-REQUISITES	Basic knowledge of ICT
EQF LEVEL (Recommended)	EQF LEVEL 4

Title	IoT Microcontroller Developer
Label	IoT Microcontroller Developer
Areas of activity	The holder of the "IoT Microcontrollers developer" certification could work in the following business areas: • IoT Expert/Developer • IoT Administrator
Organizational Contexts	In SMEs implementing/offering IoT services; In organizations acting in different economic sectors
Organizational Roles	Analyse the existing IoT service in relation with the company's needs; implement IoT services within the company; manage the selection and the implementation of sensors, actuators and buses; propose customized solutions for creating an IoT based business; select and implement programming languages; set up, configure and connect devices to IoT platforms providers; provide feedback to IoT users on the proper networking and communication protocol to be implemented in IoT environments; manage different IoT environments; provide support in specific security issues.
Core Competence Units	1. Introduction: IoT technology and business strategy 2. Device architecture and sensors for microcontrollers 3. Programming microcontrollers 4. Platforms for microcontrollers and applications 5. Networking and Security (for microcontrollers)
Units overview	**1. Introduction: IoT technology and business strategy:** Students are expected to demonstrate theoretical knowledge/skills and competences on IoT: terms and basic concepts; technological trends which have led to IoT; embedded systems in terms of interface; impact of IoT on organizations/society; main application sectors; basics of hardware components (microcontrollers and microprocessors, sensors, actuators); basics of communication technologies and platforms; commonalities and differences between IoT and other

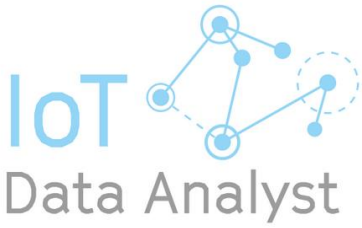
	technologies (e.g. Cloud computing, Big Data, Industry 4.0); IoT national and international policies. Additionally, they are expected to have factual knowledge of: features of product and services interconnected; IoT benefits and challenges; new business opportunities and competitive risks; IoT business solutions main features; IoT Solutions from user, business, operational, revenue and cost perspectives; introduction of IoT into business: i. strategy and alignment ii. Organization iii. Budgeting iv. Product development v. manufacturing vi. Distribution vii. Customer satisfaction viii. IoT solution; creation of successful IoT business for SMEs (how to implement an IoT business). **2. Device architecture and sensors for microcontrollers:** Student is expected to demonstrate specialized knowledge, skills and competences on: basic concepts of device architecture; basics of sensors and actuators issues; analog sensors: voltage vs current; digital sensors: on/off, parallel, serial, asynchronous vs synchronous; Pulse Width Modulation; buses (Binary Unit Systems): I2C, SPI; connection technology. **3. Programming microcontrollers:** Students are expected to demonstrate deep knowledge of: microcontroller and C programming basics; Arduino; Arduino programming with Arduino IDE; Arduino I/O programming; STM32; STM32 programming with Eclipse; TM32 I/O programming; building blinking LEDs; controlling motors; networking sensors. **4. Platforms for microcontrollers and applications:** Students are expected to demonstrate comprehensive knowledge, skills and competences on: connecting Iot devices to local or global network; Low and High level Protocols dedicated to IoT devices; IoT platforms: ThinkSpeak, ThinkWorx, Ubidots, etc. **5. Networking and Security (for microcontrollers)** At the end of this unit the student is expected to demonstrate comprehensive knowledge, skills and competences on: networking protocols for IoT environments; communication protocols for IoT environments; IoT security basics; Hardware and

	Software vulnerabilities in microcontrollers (Arduino example); Security risks regarding the implementation of networking and communication protocols.
PRE-REQUISITES	Basic knowledge of programming.
EQF LEVEL (Recommended)	EQF LEVEL 5

Title	IoT Microprocessor Developer
Label	
Areas of activity	The holder of the "IoT Microprocessors Developer" certification could work in the following business areas: • IoT Expert/Developer • IoT Administrator
Organizational Contexts	In SMEs implementing/offering IoT services In organizations acting in different economic sectors.
Organizational Roles	Analyse the existing IoT service in relation with the company's needs; implement IoT services within the company; manage the selection and the implementation of sensors, actuators and buses; propose customized solutions for creating an IoT based business; select and implement programming languages; set up, configure and connect devices to IoT platforms providers; provide feedback to IoT users on the proper networking and communication protocol to be implemented in IoT environments; manage different IoT environments; provide support in specific security issues.
Core Competence Units	1. Introduction: IoT technology and business strategy 2. Device architecture and sensors for microprocessors 3. Programming microprocessors 4. Platforms for microprocessors and applications 5. Networking and Security (for microprocessors).
Units overview	**1. Introduction: IoT technology and business strategy:** Students are expected to have factual knowledge, skills and competences of: IoT terms and basic concepts; technological trends which have led to IoT; embedded systems in terms of interface; impact of IoT on organizations/society; main application sectors; basics of hardware components (microcontrollers and microprocessors, sensors, actuators); basics of communication technologies and platforms;

	commonalities and differences between IoT and other technologies (e.g. Cloud computing, Big Data, Industry 4.0); IoT national and international policies. Additionally they are expected to have factual knowledge of: features of product and services interconnected; IoT benefits and challenges; new business opportunities and competitive risks; IoT business solutions main features; IoT Solutions from user, business, operational, revenue and cost perspectives; introduction of IoT into business: i. strategy and alignment ii. Organization iii. Budgeting iv. Product development v. manufacturing vi. Distribution vii. Customer satisfaction viii. IoT solution; creation of successful IoT business for SMEs (how to implement an IoT business). **2. Device architecture and sensors for microprocessors** Student is expected to demonstrate specialized knowledge, skills and competences on: basic concepts of device architecture; basics of sensors and actuators issues; analog sensors: voltage vs current; digital sensors: on/off, parallel, serial, asynchronous vs synchronous; Pulse Width Modulation; buses (Binary Unit Systems): I2C, SPI; connection technology **3. Programming microprocessors** This unit is focus on microprocessors programming. Students are expected to master and demonstrate deep knowledge of: basics of microprocessors and Python programming; Python programming in Raspberry Pi; Raspberry Pi I/O programming. Additionally, students are expected to have specialized knowledge of: programming Raspberry Pi's output pins; reading sensor data from Raspberry Pi's input pins; interfacing sensor with the Operating System **4. Platforms for microprocessors and applications** Students are expected to demonstrate comprehensive knowledge, skills and competences on: connecting Iot devices to local or global network; Low and High level Protocols dedicated to IoT devices; IoT platforms: ThinkSpeak, ThinkWorx, Ubidots, etc.

	5. Networking and Security (for microcontrollers) At the end of this unit the student is expected is expected to have deep knowledge of: networking protocols for IoT environments; communication protocols for IoT environments; IoT security basics; Hardware and Software vulnerabilities in microprocessors (Raspberry Pi example); Security risks regarding the implementation of networking and communication protocols
PRE-REQUISITES	Basic knowledge of programming
EQF LEVEL (Recommended)	EQF LEVEL 5

Title	IoT Data Analyst
Label	
Areas of activity	The holder of the "IoT Data Analyst" certification could work in the following business areas: • IoT Expert/Developer; • IoT Administrator.
Organizational Contexts	In SMEs implementing/offering IoT services In organizations acting in different economic sectors
Organizational Roles	Analyse the existing IoT service in relation with the company's needs; supervise the design and implementation of IoT components and services; propose customized solutions for creating an IoT based business; manage the selection and the implementation of sensors, actuators and buses; provide feedback to IoT users on the proper networking and communication protocol to be implemented in IoT environments; implement cloud storage and cloud analytics services and technologies; implement Big Data Analytics techniques for IoT environments; set up, configure and connect devices to IoT platforms providers.
Core Competence Units	1. Introduction: IoT technology and business strategy 2. Device architecture and sensors 3. Networking and Security 4. IoT data analysis 5. IoT platforms.
Units overview	**1. Introduction: IoT technology and business strategy**: Students are expected to have factual knowledge, skills and competences of: IoT terms and basic concepts; technological trends which have led to IoT; embedded systems in terms of interface; impact of IoT on organizations/society; main application sectors; basics of hardware components (microcontrollers and microprocessors, sensors, actuators); basics of

	communication technologies and platforms; commonalities and differences between IoT and other technologies (e.g. Cloud computing, Big Data, Industry 4.0); IoT national and international policies. Additionally, they are expected to have factual knowledge of: features of product and services interconnected; IoT benefits and challenges; new business opportunities and competitive risks; IoT business solutions main features; IoT Solutions from user, business, operational, revenue and cost perspectives; introduction of IoT into business: i. strategy and alignment ii. Organization iii. Budgeting iv. Product development v. manufacturing vi. Distribution vii. Customer satisfaction viii. IoT solution; creation of successful IoT business for SMEs (how to implement an IoT business). **2. Device architecture and sensors for microprocessors:** Student is expected to demonstrate specialized knowledge, skills and competences on: basic concepts of device architecture; basics of sensors and actuators issues; analog sensors: voltage vs current; digital sensors: on/off, parallel, serial, asynchronous vs synchronous; Pulse Width Modulation; buses (Binary Unit Systems): I2C, SPI; connection technology **3. Networking and Security:** Students are expected to have factual knowledge, skills and competences of: networking protocols for IoT environments; communication protocols for IoT environments; IoT security basics; Hardware and Software vulnerabilities; Security risks regarding the implementation of networking and communication protocols **4. IoT data analysis:** Students are expected to demonstrate specialized knowledge, skills and competences on: cloud storage and cloud analytics basics; data management tools: big data for IoT, Big Data Analytics techniques, basics of Hadoop Data Management, basics of "R" for statistical purposes; introduction to machine learning; machine learning classification techniques; Bayesian prediction; Image and video analytic for IoT; Options for the implementation of machine learning for IoT; Biometric ID integration with

	IoT; Real time analytic/stream analytic; Scalability issues for IoT and machine learning; Visualization analytic; Structured and unstructured predictive analytics Recommendation engines; Pattern direction; Frameworks for distributed data analysis **5. IoT platforms:** At the end of this unit the student is expected to demonstrate comprehensive knowledge, skills and competences on: connecting Iot devices to local or global network; Low and High level Protocols dedicated to IoT devices; IoT platforms: ThinkSpeak, ThinkWorx, Ubidots, etc.
PRE-REQUISITES	Basic knowledge of programming
EQF LEVEL (Recommended)	EQF LEVEL 5