COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	8.022	**SEMESTER OF STUDY**	8th
COURSE TITLE	Internet of Things		
COURSEWORK BREAKDOWN		**TEACHING WEEKLY HOURS**	**ECTS Credits**
	Theory (Lectures)	3	2
	Tutorial/Project	1	0.5
	Laboratory	1	1.5
	TOTAL	**5**	**4**
COURSE UNIT TYPE	Special background		
PREREQUISITES	None		
LANGUAGE OF INSTRUCTION/EXAMS	Greek		
COURSE DELIVERED TO ERASMUS STUDENTS	No		
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE187/		

(2) LEARNING OUTCOMES

Learning Outcomes

The theoretical part of the course extends the classic automatic control systems with the modern technologies, mechanisms and abstract interfaces proposed in the Internet of Things for remote monitoring, control of devices and facilities, data visualization, decision making, resource management, user friendliness. Therefore, the basic cycle of autonomous systems that obeys the "Monitoring - Decision – Execution" triptych, on the Internet of Things needs to be generalized in order to acquire scaling and application capabilities ranging from the narrow confines of a home, greenhouse or industry to coverage of entire cities, geographical areas or even global coverage. In this light, the possibility of communication and interoperability between remote entities that are subsystems of the same overall system or application becomes particularly critical.

Upon successful completion of the course the student will be able to:

1. Understand the basic architecture of Internet of Things systems and applications.
2. Interconnect various types of sensors (e.g. environmental sensors, infrared sensors, ultrasonic sensors, RTC) and actuators (e.g. relays and motors) with microcontrollers.
3. Interconnect microcontrollers via serial communication protocols (e.g. I2C, SPI, UART).
4. Program and install wireless sensor networks (Wireless Sensor Networks) over popular data communication protocols (e.g. Bluetooth, Ethernet, WiFi).
5. Control nodes via internet and / or mobile devices.
6. Collect, process, visualize data related to sensor networks.
7. Compile its own applications for the Internet of Things.

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Autonomous work
- Teamwork
- Work in an interdisciplinary environment
- Production of new research ideas

(3) SYLLABUS

Theoretical Lecture Units

- Sensors' classification and technologies
- actuators' classification and technologies
- microcontrollers' technologies
- basic serial communication protocols
- network technologies and interconnection protocols
- sensor network technologies
- wireless networking technologies
- LPWAN networks
- technologies for the organization of the network and processing infrastructure on the server side – virtualization of resources
- decision making and data processing techniques
- closed loop distributed systems
- interfaces and interaction protocols with emphasis on mobile and web-based implementations
- Machine-to-Machine (M2M) message exchange protocols
- interaction between physical and virtual worlds
- security issues related to data exchange and systems interconnection
- industrial Internet of Things

- practical applications and examples

Laboratory Exercises

The proposed laboratory exercises aim to support the theoretical part of the course with emphasis on the implementation of IoT applications. Laboratory programming exercises will be performed in Arduino and Raspberry Pi environments using various sensors and actuators related to:

1. The interconnection with the internet of different types of sensors (e.g. environmental sensors, infrared sensors, ultrasound sensors, RTC)
2. The interconnection with the internet of different types of actuators (e.g. relays and motors)
3. Various serial communication protocols (e.g. I2C, SPI, UART, 1-wire)
4. Various data communication protocols (e.g. Bluetooth, Ethernet, WiFi)
5. Connection and control of devices via the internet
6. Connection and control of devices via mobile phones
7. Message exchange M2M protocols
8. Installation and programming of sensor networks (Wireless Sensor Networks)
9. Implementation of closed-loop distributed systems
10. Interface with industrial PLCs

(4) TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	In-Class Face-to-Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	• Use of ICTs in lecturing • Use of ICTs in laboratory-based training • Use of ICTs for the communication with students via the e-class platform
TEACHING ORGANISATION	**Method description / Activity** / **Semester Workload** Lectures: 52 Laboratory work: 13 Non-guided personal study: 17 Project-based assignments: 25 Homework: 13 **Total Contact Hours: 120**
ASSESSMENT METHODS	**Language of Assessment** Greek **Student assessment methods** 1. Written final examination (40%) • with exercises • with multiple choice questions 2. teamwork assignment for the theoretical part of the course (with written report and oral assessment) (20%). 3. teamwork assignment for the laboratory part of the course (with written report and oral assessment) (30%). 4. Homeworks (10%). The course evaluation criteria are announced to the students at the beginning of the semester and are posted on the course website in eClass.

(5) RECOMMENDED BIBLIOGRAPHY

- Recommended Bibliography:

1. *Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1stEdition, Academic Press, 2014.*
2. *Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer*
3. *Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.*
4. *Internet of Things Protocols and Standards, http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.htm*
5. *Mark Weiser (1991) The computer for the 21st century. Scientific American, pp. 94–104*
6. *Paul Dourish and Genevieve Bell, 2008. Yesterday's Tomorrows: Notes on Ubiquitous Computing's Dominant Vision. Personal and Ubiquitous Computing.*
7. *Prolog, Chapter 1, and Chapter 4 from David Rose (2014) Enchanted Objects: Design, Human Desire and The Internet of Things, Scribner.*
8. *Chapter 16, Nabaztag, an Ambiguous Avatar, from Mike Kuniavsky (2010) Smart Things, Ubiquitous Computing User Experience Design, Elsevier*
9. *Rogers Y, Hazlewood W, Marshall P, Dalton NS, Hertrich S, (2010) Ambient Influence: Can Twinkly Lights Lure and Abstract Representations Trigger Behavioral Change?, UbiComp 2010*
10. *The Secret Life of Electronic Objects - A Dunne, F Raby (2002) Design Noir: The Secret Life of Electronic Objects*

- Relevant Scientific Journals:

- *IEEE Internet of Things Journal*
- *IEEE Sensor Journal*
- *International Journal of Sensor Networks*
- *Future Generation Computer Systems*
- *IEEE Access*
- *Internet of Things - Journal – Elsevier*
- *MDPI Sensors*
- *IEEE Communications Surveys and Tutorials*
- *IEEE Communications Magazine*
- *Springer Internet of Things*
- *Personal and Ubiquitous Computing – Springer*
- *Pervasive and Mobile Computing – Elsevier*
- *Pervasive Computing, IEEE*