Internet of Things (IoT)

Telecommunication Research Lab (TRL), Department of Computer Science

Faculty of Computer Science - 2019

Credit Hours: (2,1;3)

Course Code: ICT/CSE 5XX

**Objective and Description**

Internet of Things course is all about understanding and then developing solid skills to build Internet of Things (IoT) systems. This is a very hands-on intensive and interactive course. Much of the course material will be delivered in using the flipped lectures based model where pre-work will be given to students before they come to sessions. Largely, the sessions are based on hands-on workshops where students will perform different programming and development tasks

A number of devices, platforms and software tools will be introduced throughout the course from different vendors.

For Example:

* Using the FIT IOT-LAB for development of testbeds for network computer communications.
* IBM BLUEMIX for Cloud Development.
* Arduino and Raspberry Pi for building embedded systems.
* TelosB Motes.
* SDN based IoT.

Towards the end of the course, two case studies will be introduced to help students apply acquired knowledge to area of Supply Demand and developing an IoT Ecosystem.

**Class Strength**

Only first ten applications from MS/BS students for enrollment will be entertained.

**Prerequisites**

Computer Communication & Networking.

Must know:

Unix O/S and shell scripting.

Must have:

Knowledge of Python, C/C++ or a similar programming language.

**Outcomes**

On completion of this course, students will be able to:

* Explain and define “Internet of Things” in different contexts.
* Take account of the key components that make up an IoT system.
* Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
* Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping and programming.
* Understand where the IoT concept rightly fits within the broader ICT industry and possible future trends.

**Guest Speakers**

Potential speakers from University of Tempere, American Research Institutes and SUPARCO will be invited through video conferencing to share their perspectives on the state of the art in the IoT industry.

**Recommended Reading Material**

* J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
* Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note, 2016.

**Case Studies**

* Jeremy B. Dann; Katherine Bennett; Andrew Ogden, “Xiaomi: Designing an Ecosystem For the "Internet of Things"”, HBR, 2017.
* Felipe Caro; Ramin Sadr, “The Internet of Things (IoT) in Retail: Bridging Supply and Demand”, HBR, 2019.

**Outline**

1. Basics of Electronic Designs
   * ADCs/DACs, PVM and Voltage Dividers
2. Basics of Networking
   * Understanding the OSI model and the seven abstraction layers.
   * Networking and TCP/IP.
3. SDN Architecture
   * Control and Management plane improvements with SDN
   * Openness
   * Network Automation and Virtualization
   * SDN and OpenStack
   * ONOS SDN Controllers
   * Applications and APIs
   * Protocols
4. Arduino and Raspberry Pi Programming
5. \*Introduction to the Internet of Things
   * IoT and its importance
   * Elements of an IoT ecosystem
   * Technology and business drivers
   * IoT applications, trends and implications.
6. Sensors and sensor nodes
   * Sensing components and devices.
   * Sensor modules, nodes, motes and systems.
7. Connectivity and networks
   * Wireless technologies for the IoT.
   * Edge connectivity and protocols.
   * Wireless sensor networks
8. IoT lab exercises
   * Local processing on the sensor nodes.
   * Connecting devices at the edge and to the cloud.
   * Processing data offline and in the cloud.

**Assessment:**

Through Quizzes, Reports, Presentation, Demonstration and Viva examination.

**Grading:**

Participation: 10%

Hands-on Exercises/Quizzes/Presentation/Reports: 30%

Midterm: 20%

Final Exam: 40%