

Macao Polytechnic Institute

School of Applied Sciences

Master of Science in Big Data and Internet of Things

Module Outline

Academic Year 2021 / 2022 Semester 1

Learning Module	Introduction to the Internet of Things			Class Code	COMP6121
Pre-requisite(s)	Nil				
Medium of Instruction	English			Credit	3
Lecture Hours	45 hrs	Lab/Practice Hours	0 hrs	Total Hours	45 hrs
Instructor	K. L. Eddie Law		E-mail	eddielaw@ipm.edu.mo	
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Description

This module provides a comprehensive overview of the Internet of Things (IoT) from the global context. A number of underlying technologies enabling IoT will be discussed, such as different sensing technologies, wireless sensor networks, machine-to-machine communications, Cloud and Fog computing technologies, etc. The IoT environment should permit interaction among machines, smart devices, ubiquitous computers, physical objects and human users. This module is an introduction to the fundamentals of IoT, designed for either Information Communication Technology (ICT) or non-ICT students. In particular, the course will define the core system architectures, including but not limited to, the middleware to design single device and multi-device systems. In order to obtain more hands-on experience in building IoT applications through different smart sensing devices, constructions of smart sensor devices through experiencing the Arduino and Raspberry Pi device programming will be covered.

Learning Outcomes

After completing the learning module, students will be able to:

1. Justify the need of IoT in a range of complex application domains; (SM1fl, SM2fl, ET2fl)
2. Critically evaluate heterogeneous devices; (EA1fl)
3. Synthesize functional IoT systems through various programmable sensors/devices; (EP2fl, EP1fl, EP3fl)
4. Justify the roles of various technologies in enabling IoT; (SM3fl)

5. Analyze and determine the domain requirements for building different complex IoT solutions; (ET3fl)
6. Design advanced the IoT-based applications based on user needs. (D1fl, D2fl, D3fl)

Content

1. Introduction (3 hours)
 - 1.1 Understand the concept to IoT and some feature applications
 - 1.2 Master the design ideas of wireless sensor networks and machine-to-machine communications
 - 1.3 Define sensing devices and sink/gateway components
2. Model and Architecture of IoT (3 hours)
 - 2.1 Identify basic components and architecture of an IoT system
 - 2.2 Discuss the operating models of the Internet and Cloud Computing
 - 2.3 Outline the relationship between fog/edge computing and the wireless sensor networks
3. Sensing devices (3 hours)
 - 3.1 Elaborate the physics underneath the sensing devices
 - 3.2 Apply sensing devices to different scenarios and applications
4. Hardware platforms for IoT devices (9 hours)
 - 4.1 Review the common coding practice with different single board computers
 - 4.2 Understand Arduino programming – IoT implementation with Arduino
 - 4.3 Understand Raspberry Pi programming – IoT implementation with Raspberry Pi
5. Network architecture and communication protocols (12 hours)
 - 5.1 Describe the differences in routing operations between IPv4 and IPv6
 - 5.2 Define routing protocols among sensors and gateways, e.g., the IPv6 Routing Protocol for Low Power and Lossy Networks (RPL)
 - 5.3 Explore the 6Lo protocols for higher level protocols
 - 5.4 Refine the reliability issues among link layer and transport layer protocols – UDP & TCP
6. Application Layered Protocols (9 hours)
 - 6.1 Understand the needs of sensor management
 - 6.2 Describe application layered protocols, including
 - 6.2.1 Constrained Access Protocol (CoAP)
 - 6.2.2 Message Queue Telemetry Transport (MQTT) and MQTT-SN
 - 6.2.3 Advanced Message Queueing Protocol (AMQP)
 - 6.2.4 Extensible Messaging and Presence Protocol (XMPP), etc.
7. Security and privacy for IoT systems (3 hours)
 - 7.1 Investigate case studies
8. Other design issues for IoT (3 hours)
 - 8.1 Topics: describe interoperability and reliability issues

Teaching Method

Lectures, videos, case studies, group discussion

Attendance

Attendance requirements are governed by the “Academic Regulations Governing Master’s Degree Programmes of Macao Polytechnic Institute”. Students who do not meet the attendance requirements for the module shall be awarded an ‘F’ grade.

Assessment

The learning module is graded on a 100 point scale, with 100 being the highest possible score and 50 being the passing score.

Item	Description	AHEP3 LO	Percentage
1. Assignments	Knowledge assessment	EA1fl, EP1fl,EP2fl, EP3fl	35%
2. Test	Knowledge assessment	SM1fl, SM2fl,SM3fl, ET2fl	25%
3. Group Project	Knowledge assessment	EA1fl, EP1fl,EP2fl, EP3fl, D1fl, D2fl,D3fl	40%
Total Percentage:			100%

Teaching Material(s)

Textbook(s)

There is no official text for this module. Module notes are distributed in classes.

Reference

Reference book(s)

1. Cirani S., Ferrari G., Picone M., Veltri L. (2019) Internet of Things – Architectures, Protocols and Standards, John Wiley & Sons Ltd.
2. Lea P. (2018) Internet of Things for Architects, Packt Publishing.

Website(s)

3. Arduino Reference – <https://arduino.cc/references/en/>
4. Raspberry Pi Documentation – <https://raspberrypi.org/documentation/>