Detailed Course Content / Modules:

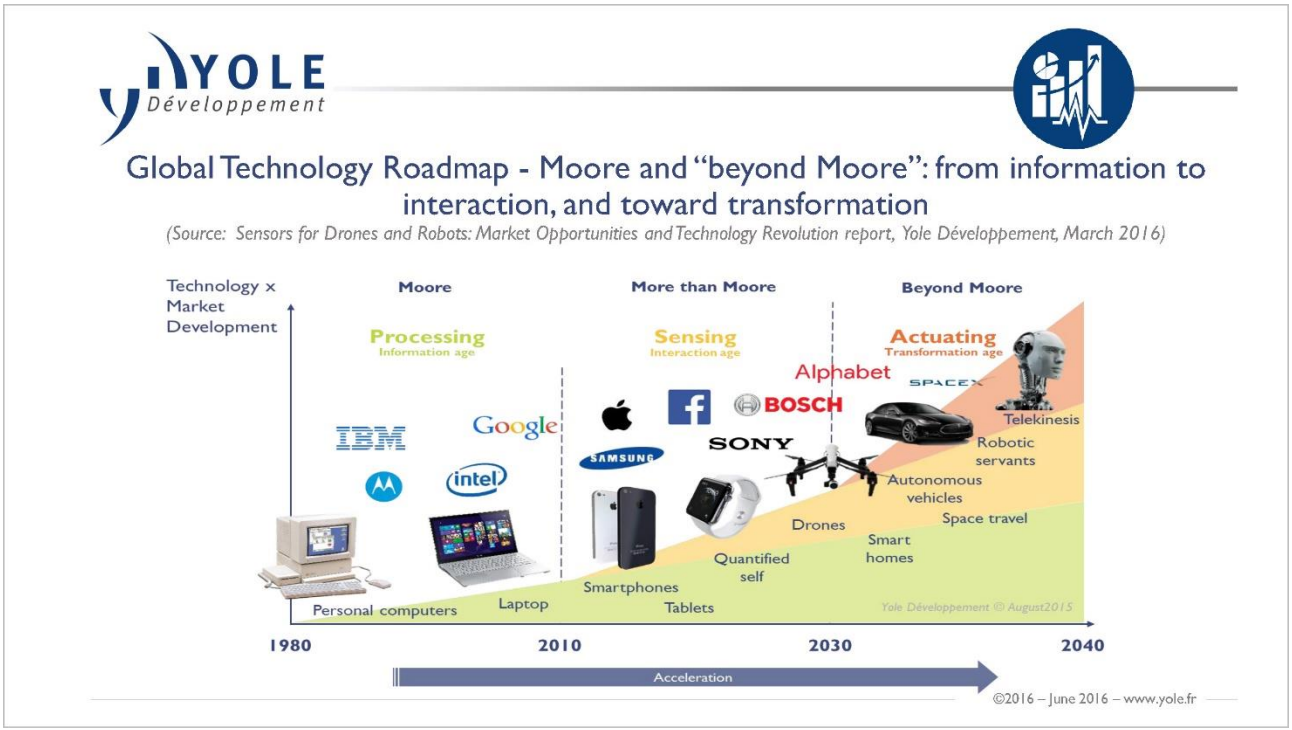

Figure 1. Global Technology Roadmap depicting the progression/age of industry competition areas and IoT product range exemplars (Illustration used with Permission; Yole Developpement (2016)[1], www.yole.fr).

MIOT H6011 Embedded Systems [10 ECTS]

This modules reviews fundamental Embedded Systems technologies, tools and techniques before moving on to explore more specific techniques used in IoT Systems. The learner will examine and analyse various device platforms and be able to select appropriate hardware for specific situations. Key technologies examined will be device selection, IoT RTOSs, Embedded Linux and IoT wireless technologies. All will be considered from the perspectives of suitability, unit cost, development cost and power consumption.

On successful completion of this module the learner will be able to:

(1) Demonstrate mastery of basic Embedded System tools and techniques.
(2) Fast-prototype IoT devices, backend and client applications using Javascript based or other RAD tools.
(3) Design, build and test a low-power IoT wireless sensor network and supporting backend framework using specified technologies.

MIOT H6012 Information Transmission & Management [10 ECTS]

This module provides an overview of concepts and technologies used in the transmission and storage of information for modern IoT systems. It is intended to supplement the IoT embedded systems module by considering the higher level infrastructure that supports both "data concentration" and "store and forward" on IoT devices, and "data aggregation" in a large scale destination information repository in preparation for data analytics and other processes.

On successful completion of this module the learner will be able to:

(1) Identify and analyse various aspects of data transmission and storage, the student will be able to apply the associated range of theoretical and practical considerations in the design of IoT systems.

[1] Yole Developpement. 2015. Sensors for Drones and Robots: Market Opportunities and Technology Revolution Report. Available online at: www.yole.fr <Accessed on: June 20, 2016>

(2) Describe the operation of network protocols and why networking standards are critical element of the IoT. The student will acquire an in depth knowledge of the TCP/IP protocol, sockets and higher level protocols running over TCP/IP.
(3) Demonstrate an understanding of a range of wireless networking technologies.
(4) Identify and describe the benefits of different Client Server architectures for IoT systems. Identify how Message Oriented Middle-ware (MOM) has been adapted for distributed, resource-limited architectures.
(5) Demonstrate through formal approaches how data can be represented, transmitted and stored in network communities that include resource limited devices. Appreciate how the integrity of data can be verified and data quality can be assessed.
(6) Demonstrate an understanding of the different types of database technologies currently in use. Create suitable database structures to model real world entities and demonstrate how these can be queried.

MIOT H6013 Software Engineering [5 ECTS]

This module will equip the learner with the key Software Development skills required in developing an IoT system including language skills, analysis and design skills and application of appropriate software lifecycle models.

On successful completion of this module the learner will be able to:
(1) Demonstrate programming skills in the key languages of the IoT.
(2) Critically evaluate diverse programming languages for use within an IoT system
(3) Analyse, design and test a software system.
(4) Apply basic data mining algorithms to gathered data.

MIOT H6014 Statistical Analysis for Engineers [5 ECTS]

The purpose of this module is to provide the learner with the statistical concepts and tools necessary for research in a field of engineering. The module will underpin specific engineering topics such as statistical process control, quality control and reliability analysis. To do this, the learner will cover the fundamental ideas of probability and descriptive statistics, moving on to Hypothesis testing and the design of experiments. This learning is complemented by an introduction via practical classes to several statistical software packages programs. Students are provided with the skills both to plan and carry out research and the ability to both read and critique the research of others in engineering.

On successful completion of this module the learner will be able to:
(1) Apply the laws of probability to questions involving random variables and events, and move on to the concept of a random variable and its distribution, the meaning of expected values, and the properties of common distributions such as the normal, binomial, Poisson and exponential distributions.
(2) Apply knowledge of random variables and their distributions, including the central limit theorem, to concepts in quality control.
(3) Interpret the concept of a statistic as a random variable arising from sample data, with the central limit theorem determining the behaviour of such statistics and thereby underpinning many statistical tests, and so apply a range of statistical tests.
(4) Design or explain the chosen structure of an experiment and the meaning of appropriate data analysis produced for that experiment, based on the students understanding of the properties of Analysis of Variance and other statistical tests.
(5) Write reports of trials and experiments carried out to the standard and structure required for publication and evaluate statistical analysis presented in research papers.
(6) Apply a range of typical statistical packages to the analysis of data produced in trials and experiments.

MIOT H6015 IoT Systems [5 ECTS]

This module will provide learners with the broad skills to analyse, design and build an IoT System from the "thing", Linux based edge routers/gateways, IoT mobile applications to cloud backend. Learners will explore how the key components of an end-to-end IoT system integrate. Learners will get hands on experience with

IoT enabling operating systems such as Linux based IoT gateways and node level operating systems such as Contiki. IoT Cloud frameworks are introduced, and learners will explore the challenges and solutions to remotely & securely managing IoT nodes and gateways.

On successful completion of this module the learner will be able to:
(1) Explain the key components of an IoT system and how they integrate to achieve higher levels of functionality.
(2) Specify, design and build IoT devices including low power devices exploiting an IoT RTOS and more complex devices using embedded Linux.
(3) Critically analyse existing IoT systems.
(4) Demonstrate end-to-end understanding and expertise by designing an end-to-end complete IoT system.
(5) Develop IoT based mobile applications in both cross-platform and native environments.

MIOT H6016 Secure Communication & Cryptography [5 ECTS]
The purpose of this module is to allow learners identify vulnerabilities in data communication systems and analyse and evaluate the different types of encryption and security processes available. The module with teach and demonstrate how to secure data communications systems.

On successful completion of this module the learner will be able to:
(1) Analyse and evaluate the different types of encryption and security processes available
(2) Identify vulnerabilities in data communication systems
(3) Assess vulnerabilities in systems and identify limitations to the application of each technology

MIOT H6018 Technology & Innovation Management [5 ECTS, Elective]
This module reviews and analyses the business, social, ethical and legal issues that influence the process of adopting and managing innovative technology in the marketplace. It encompasses commercialisation strategies, intellectual properties, patents and copyright, management approaches, ethical principles, legal obligations and requirements. On completion, participants will have a comprehensive understanding of the issues associated with innovative technology and how to exploit and benefit from its adoption and implementing.

On successful completion of this module the learner will be able to:
(1) Appraise and evaluate the current state of Entrepreneurship and Innovation policy
(2) Develop and implement coherent strategy for the creation and protection of innovative technology
(3) Develop and evaluate a commercialisation plan for new technology.
(4) Evaluate and justify the techniques used in managing entrepreneurial organisations
(5) Implement policies and procedures in compliance with current Data Protection legislation.
(6) Categorise and evaluate the ethical challenges faced by managers in a business environment

MIOT H6019 Geodata Provisions ` [5ECTS, Elective]
This module will provide learners with the ability to develop interoperable IoT System-of-IoT-systems and IoT applications. This module emphasises the importance of location as a component of IoT enabled devices and IoT data; from acquisition to storage, data models, analytics. Learners will explore the latest interoperability standards and technologies relating to geographical data and information, and how they can be used within an IoT system and IoT applications. Learners are also introduced to the concept of the Web-of-things and associated technologies.

On successful completion of this module the learner will be able to:
(1) Describe fundamental geographic concepts and principles underlying geographic data for GIS and IoT Systems
(2) Demonstrate awareness and critical understanding of the challenges in realising IoT Applications and the Web of Things

(3) Source and access current research and best practice relating to geospatial data capture & representation
(4) Select and justify appropriate systems & techniques to enable interoperability and sharing of geo-data amonst IoT systems
(5) Apply innovative approaches to the use geo-data and information standards to enable the development system-of-IoT systems

MIOT H6020 Advanced Signal Processing [5 ECTS, Elective]

The aim of this module is to introduce the learner to DSP algorithms and how they can be employed to solve problems in the context of Internet of Things applications. This will include spectral estimation, digital filtering, modelling and Kalman filtering.

On successful completion of this module the learner will be able to:
(1) Outline and explain the applications of DSP, the role of each component in a DSP system and how DSP is utilised in Internet of Things technologies.
(2) Analyse and interpret signal characteristics in the time and frequency domains.
(3) Implement digital signal processing algorithms in a programming environment.
(4) Design and analyse digital filters.
(5) Implement and evaluate Kalman filtering as a tool to deal with imperfect sensor measurements in the context of Internet of Things technologies.

MACS H6011 Network Security [10 ECTS, Elective]

Module content includes: Investigation of core security technologies and security policies to mitigate risks. Ability to review procedures for installation, troubleshooting and monitoring of network devices to maintain integrity, confidentiality and availability of data and devices. Knowledge of the technologies that underpin the deployment and maintenance of a secure network.

On successful completion of this module the learner will be able to:
(1) Appraise the underlying theories of networking communication protocols and application protocols.
(2) Investigate and appraise popular Intrusion Detection and Prevention Systems.
(3) Expertly utilise traffic analysis tools to critically analyse network traffic and identify signs of an intrusion

ADSA H6018 Programming for Big Data [10 ECTS, Elective]

Students taking this module will acquire the computer programming skills necessary to analyse and manipulate big data. Big data in this context refers to datasets that are too large to be handled by the software tools commonly used to analyse and manipulate data within a tolerable elapsed time. The algorithms and challenges for processing large datasets form a core part of this course, such that the student will be able to select the appropriate algorithms, tools or methods for big data problems in addition to being able to implement and evaluate solutions using a variety of programming techniques and tools. Students are not expected to have advanced programming skills in order to take the module, but will need to have fundamental knowledge and skills in computer programming.

On successful completion of this module the learner will be able to:
(1) Clearly describe the characteristics of big data, and contrast the requirements for processing big data with conventional data.
(2) Identify and illustrate the challenges of programming for big data, and evaluate contrasting methods for addressing these challenges.
(3) Demonstrate a detailed understanding of the state of the art in Big Data algorithms and techniques.
(4) Select and evaluate the appropriate development tools for various big data programming problems.

(5) Demonstrate a detailed understanding of state of the art distributed programming paradigms for both data storage and data analysis, and select the appropriate method for a given context.
(6) Implement solutions to various big data programming problems using a range of state of the art tools and techniques, and evaluate the effectiveness of these solutions.
(7) Present an informed view of the changing big data landscape and how programming for big data may change in the future, based on current literature and standards.

MIOT H6022 Research Project [30 ECTS]

This research project module will prepare the graduate to undertake research at masters level. The module will enable the learner to evaluate the various research methods and to understand stages in the research process. Experimental designs are compared and contrasted and the learner will be required to complete a comprehensive literature review to support their own research proposal. The proposal stage will be followed by a one semester project implementation and presentation stage that will enable the graduate to gain some experience of research at postgraduate level. This 30 credit module will provide the learner with a grounding in the skills required to be ready to perform more comprehensive, in depth, research in either an industry role or as part of further academic study.

On successful completion of this module the learner will be able to:
(1) Identify methods and procedures appropriate for addressing selected research and evaluation topics and problems.
(2) Locate and report on relevant existing work and research relating to a project question as part of a literature and technology review, demonstrating appropriate academic citation and referencing
(3) Be familiar with the purposes and general procedures involved in experimental design and data gathering techniques.
(4) Plan, undertake and document a substantial project, demonstrating effective use of communication in the form of technical prose, formal notations, technical diagrams, algorithms and data.
(5) Communicate the research process and outcomes by means of a dissertation and oral presentations.

MIOT H6023 Research Project [60 ECTS]

This research project module will produce a graduate with comprehensive research skills and experience at postgraduate level. The module will enable the learner to evaluate the various research methods and understand and implement the stages in the research process. Experimental designs are compared and contrasted and the learner will be required to complete a comprehensive literature and technology review to support their own research proposal. This proposal will be complete in nature, and will be required to be presented at a high standard. The research skills training and proposal stage will be followed by a two semester project implementation and presentation stage that is sufficiently defined in scope such that it will produce a graduate who is clearly capable of doing independent research. The graduate will have produced a thesis that is a measurable contribution to the field, with publishable work completed during the course of the research.

On successful completion of this module the learner will be able to:
(1) Demonstrate self-direction and originality in selection of research questions, planning tasks and solving problems during a research project
(2) Prepare a comprehensive literature review or critical evaluation of existing research literature and/or technical and professional guidance on the specific topic or technology pertinent to the research work
(3) Evaluate the research findings in relation to applicable techniques, theoretical limitations and experimental or design considerations
(4) Synthesise appropriate conclusions and findings through knowledge and systematic understanding of the research process and any limitations of the work
(5) Communicate the outcomes of research to professional standards through a dissertation, poster and oral presentation. Prepare this work for presentation in a peer-reviewed publication