Module Name: The Internet of Things
Module Acronym: IOT
Module Manager: Dr Clive Poole

Course Summary:
The course is designed to provide an introduction to the Internet of Things (IoT) for postgraduate students who already have a background in electronic engineering or a related subject, an understanding of basic networking and some software (coding) experience. The course is designed to give the students a solid grounding of the key technologies involved and how they are integrated to form complete IoT systems. We also aim to give students an understanding of how the internet of things fits within the wider context of the ICT industry.

The course has a significant practical content in that 50% of the time will be spent on practical lab exercises, involving IoT system design and software development. The students will then have 3 weeks to complete a group project. The project will be based on one of a selection of scenarios proposed for students to choose from and which will require students to build and demonstrate a simple IoT system to perform a specific task.

The course is run in conjunction with ARM (http://www.arm.com/) and will make extensive use of the "Lab-in-a-Box" platform provided by ARM, and associated educational materials. The “Lab-in-a-Box” is a complete education kit consisting of both hardware and software to support IoT learning. The students will be given an introduction to the “Lab-in-a-Box” platform as part of the course. There will also be an Android programming tutorial that the students will be expected to have completed as pre-work.

Intended Learning Outcomes
On completion of this course, students should be able to:

- Explain the definition and usage of the term “The Internet of Things” in different contexts.
- Understand where the IoT concept fits within the broader ICT industry and possible future trends.
- Understand the various network protocols used in IoT.
- Be familiar with the key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.
- Understand and be able to explain the role of big data, cloud computing and data analytics in a typical IoT system.
- Design a simple IoT system comprising sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.
- Build and test a complete, working IoT system.
 Course Content

Introduction to the Internet of Things (IoT)
- What is the Internet of Things (IoT)?
- Technology drivers
- Business drivers
- Typical IoT applications
- Trends and implications

IoT Architectures
- Architectures for IoT
- Elements of an IoT Architecture
- Architectural design considerations

IoT Network protocols (MAC layer)
- Wireless sensor networks (WSNs) and power consumption
- CSMA/CA and slotting
- Centralized vs. distributed
- State-of-the-art MAC-layer protocols for WSNs

Wireless technologies for IoT (Layer 1 & 2)
- WiFi (IEEE 802.11)
- Bluetooth/Bluetooth Smart
- ZigBee/ZigBee Smart
- UWB (IEEE 802.15.4)
- 6LoWPAN
- Proprietary systems

IoT application programming
- Introduction to IoT device programming.
- IoT application development.

Data analytics for IoT
- A framework for data-driven decision making
- Descriptive, Predictive and Prescriptive Analytics
- Business Intelligence and Artificial Intelligence
- Importance of impact and open innovation in data-driven decision making

IOT lab exercises and Mini-project
- Lab exercise: introduction to the “Lab-in-a-box”
- Lab exercise: Android programming
- Mini-project: a working IoT system (group exercise)

Assessment:
Assessment is by group project and individual written project report.
MSc Communications Programmes

Guest Speakers:
A visiting speaker from ARM and possibly one other relevant organisation will be invited to share their perspective on the current state of the IoT industry.

Suggested Reading


Pre-work:
Students will be expected to have familiarized themselves with the following as pre-work before the module starts: