**University of the West of Scotland**
**Module Descriptor**
Published 2024/25 Module Descriptor

## Session: 2024/25

| **Title of Module: Internet of Things (IoT) and Applications** | | | |
|---|---|---|---|
| **Code: COMP11061** | **SCQF Level: 11** (Scottish Credit and Qualifications Framework) | **Credit Points: 20** | **ECTS: 10** (European Credit Transfer Scheme) |
| **School:** | School of Computing, Engineering and Physical Sciences | | |
| **Module Co-ordinator:** | Muhammad Zeeshan Shakir | | |

**Summary of Module**

Internet of Things (IoT) is an emerging networking paradigm that connects various objects such as medical sensors, household appliances, gas and electricity meters, vehicles, and aeroplanes to the Internet. It uses sensors, wireless sensor networks, Radio Frequency Identification (RFID) and other sensing technologies to collect data from objects, uses intelligent data processing technologies to process the data and remote-control technologies to control the objects. It makes the networking smart, the working and living environment smart and the transport mechanism smart. Thus, it attracts attention and heavy investment from governments and industries across the globe. The aim of this module is to learn about the design and development of IoT systems, including the layered architecture of IoT, technologies and protocols on each layer, and applications of IoT. Especially hands-on skills will be developed by demonstrating, experimenting, and implementing real-life testbeds developed by the researchers in the lab.
This module focuses on overall system design and key technologies to develop an IoT system. Following topics will be covered:

1. Introduction of IoT and IoT layered architecture
2. Wireless sensor networks - design and deployment
3. Introduction to Raspberry Pi and related hardware/software
4. Wireless communications and physical layer layer protocols
5. Messaging protocols and their applications to IoT
6. MAC layer protocols and their application in IoT

This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module: Universal • Critical Thinker • Ethically-minded • Research-minded Work Ready • Problem-Solver • Effective Communicator • Ambitious Successful • Autonomous • Resilient • Driven

**Module Delivery Method**

| Face-To-Face | Blended | Fully Online | HybridC | HybridO | Work-based Learning |
|---|---|---|---|---|---|
| | ✓ | | | | |

**Face-To-Face**
Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.
**Blended**
A mode of delivery of a module or a programme that involves online and face-to-face delivery of learning, teaching and assessment activities, student support and feedback. A programme may be considered “blended” if it includes a combination of face-to-face, online and blended modules. If an online programme has any compulsory face-to-face and campus elements it must be described as blended with clearly articulated delivery information to manage student expectations

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**Fully Online**
Instruction that is solely delivered by web-based or internet-based technologies. This term is used to describe the previously used terms distance learning and e learning.
**HybridC**
Online with mandatory face-to-face learning on Campus
**HybridO**
Online with optional face-to-face learning on Campus
**Work-based Learning**
Learning activities where the main location for the learning experience is in the workplace.

| **Campus(es) for Module Delivery** | | | | | | |
|---|---|---|---|---|---|---|
| The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) | | | | | | |
| Paisley: | Ayr: | Dumfries: | Lanarkshire: | London: | Distance/Online Learning: | Other: |
| ✓ | | | | | | |

| **Term(s) for Module Delivery** | | | | | |
|---|---|---|---|---|---|
| (Provided viable student numbers permit). | | | | | |
| Term 1 | | Term 2 | ✓ | Term 3 | |

| **Learning Outcomes: (maximum of 5 statements)** |
|---|
| On successful completion of this module the student will be able to:<br>L1. Demonstrate a systematic and comprehensive understanding of the architecture and working mechanism of an IoT system.<br>L2. Demonstrate a critical understanding of key technologies in sensing, data transmission and data processing for IoT.<br>L3. Demonstrate a full understanding of the challenges in designing and securing an IoT system.<br>L4. Demonstrate the capability of following the standards in designing and implementing an IoT system.<br>L5. Develop extensive hands-on skills in developing an IoT system. |

| **Employability Skills and Personal Development Planning (PDP) Skills** | |
|---|---|
| **SCQF Headings** | During completion of this module, there will be an opportunity to achieve core skills in: |
| Knowledge and Understanding (K and U) | SCQF Level 11.<br>Students will learn systematic and comprehensive knowledge of the architecture of IoT, sensing, data transmission and data processing technologies for IoT, and the standards. Students are expected to be familiar with the key technologies of IoT and its applications in modern society. They will obtain knowledge through theoretical presentation and live demonstration of applications of IoT. |
| Practice: Applied Knowledge and Understanding | SCQF Level 11.<br>Students will gain in-depth, comprehensive understanding and critical awareness of knowledge of IoT, and apply this in planning, implementing, deploying and managing IoT systems. They will also |

| | | |
|---|---|---|
| | develop the capability to apply a range of standard and specialised research skills, tools/software, development kit and related techniques in response to application requirements for their written assignment and lab tasks. In addition, hands-on skills are going to be developed by implementing practical IoT systems. | |
| Generic Cognitive skills | SCQF Level 11.<br>To complete their written reports and laboratory tasks, students will first build skills to integrate information and apply knowledge from various sources including technology advances informed by research and industry. Furthermore, they will develop capabilities to apply critical analysis, performance evaluation and system integration to forefront IoT issues, and skills to critically review, consolidate and extend knowledge, skills and thinking to solve practical IoT problems. | |
| Communication, ICT and Numeracy Skills | SCQF Level 11.<br>Working in interacting groups, students will develop communication skills as well as the ability to write technical reports and documentation. The lecture and tutorial on advanced data transmission and processing technologies will develop numeracy skills. The labs with demonstration of IoT systems will develop advanced ICT skills. | |
| Autonomy, Accountability and Working with others | SCQF Level 11.<br>Each student in each group will be responsible for finding and summarizing information about the assigned task in the classroom. Students will elect a coordinator and develop a sense of accountability to the group members. | |
| **Pre-requisites:** | Before undertaking this module the student should have undertaken the following: | |
| | **Module Code:** | **Module Title:** |
| | **Other:** | |
| **Co-requisites** | **Module Code:** | **Module Title:** |

* Indicates that module descriptor is not published.

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| **Learning and Teaching** | |
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| This module will be delivered by means of lectures, tutorials and practical lab work aimed at developing the knowledge and skills required to confidently design and manage an IoT system. The lectures will introduce the architecture and various technologies for IoT including protocols. The lab work will enhance the learning by developing extensive hands-on skills in IoT system and allow students to design and implement technologies and protocols. Students will use latest hardware and sensors such as Raspberry Pi and digital sensors to practice hands-on skills. The tutorial sessions will help consolidate both the lecture material and the skills practiced during the lab work including demo developed by researchers. | |
| **Learning Activities**<br>During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | **Student Learning Hours**<br>(Normally totalling 200 hours):<br>(Note: Learning hours include both contact hours and hours spent on other learning activities) |

| | |
|---|---|
| Lecture/Core Content Delivery | 24 |
| Laboratory/Practical Demonstration/Workshop | 16 |
| Asynchronous Class Activity | 40 |
| Independent Study | 120 |
| | 200 Hours Total |

****Indicative Resources: (eg. Core text, journals, internet access)**

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:
Pfister, C. (2011) Getting Started with the Internet of Things. UWS Library: https://uws-primo.hosted.exlibrisgroup.com/permalink/f/1a10t95/44PAI_ALMA2119808620003931

Dieter, U., Mark, H., Florian M. (2011) Architecting the Internet of Things, London, New York: Springer Heidelbert Dordrecht. UWS Library: https://uws-primo.hosted.exlibrisgroup.com/permalink/f/1a10t95/44PAI_ALMA2123179610003931

McEwen, A., Cassimally, H. (2013) Designing the Internet of Things, John Wiley & Sons. UWS Library: https://uws-primo.hosted.exlibrisgroup.com/permalink/f/1a10t95/44PAI_ALMA2117486000003931

Holler, J, et al, (2014) From machine-to-machine to the internet of things: introduction to a new age of intelligence, Elsevier. UWS Library: https://uws-primo.hosted.exlibrisgroup.com/permalink/f/1a10t95/44PAI_ALMA5127792260003931

IEEE Internet of Things Journal
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6488907

IEEE Internet of Things Magazine
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8548628

(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

**Engagement Requirements**

In line with the Academic Engagement Procedure, Students are defined as academically engaged if they are regularly engaged with timetabled teaching sessions, course-related learning resources including those in the Library and on the relevant learning platform, and complete assessments and submit these on time. Please refer to the Academic Engagement Procedure at the following link: Academic engagement procedure

## Supplemental Information

| | |
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| **Programme Board** | Computing |
| **Assessment Results (Pass/Fail)** | No |

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| **Subject Panel** | Business & Applied Computing |
| **Moderator** | Naeem Ramzan |
| **External Examiner** | C Luo |
| **Accreditation Details** | |
| **Version Number** | 3.03 |

**Assessment: (also refer to Assessment Outcomes Grids below)**

This module is assessed by one coursework project comprising several components.

Documentation:
A detailed report, worth 60% of the marks, of the production of proof of concept (POC), with examples of software and hardware configuration should be produced, which shows the customer how this POC was developed for their environment.

Critical Review:
Student are required to produce a brief reflective summary of the project that can present ways to improve the design before commercialisation, outlines any issues, design decision or problems encountered during the design and development of the POC. Details on shortcomings of the system: where requirements are not met or other weaknesses in the system as implemented. This will be worth 10% of the marks.

Demonstration:
During the demonstration, students will be required to demonstrate that their system meets the requirements specified and that they understand the configurations they have used. This will be worth 20% of the marks.

Viva Voce:
Viva voce will be based on the answers provided by the student to a series of brief questions or tasks relating to their system. This will be worth 10% of marks.

(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.
(ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Handbook.)

## Assessment Outcome Grids (Footnote A.)

### Component 1

| Assessment Type (Footnote B.) | Learning Outcome (1) | Learning Outcome (2) | Learning Outcome (3) | Learning Outcome (4) | Learning Outcome (5) | Weighting (%) of Assessment Element | Timetabled Contact Hours |
|---|---|---|---|---|---|---|---|
| Dissertation/ Project report/ Thesis | | ✓ | | ✓ | | 60 | 0 |
| Clinical/ Fieldwork/ Practical skills | ✓ | | ✓ | | ✓ | 10 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| assessment/ Debate/ Interview/ Viva voce/ Oral | | | | | | | |
| Demonstrations/ Poster presentations/ Exhibitions | ✓ | | ✓ | | ✓ | 20 | 0 |
| Critical Review | ✓ | | ✓ | | ✓ | 10 | 0 |
| | | | | | **Combined Total For All Components** | 100% | 0 hours |

Footnotes
A. Referred to within Assessment Section above
B. Identified in the Learning Outcome Section above

Note(s):

1. More than one assessment method can be used to assess individual learning outcomes.
2. Schools are responsible for determining student contact hours. Please refer to University Policy on contact hours (extract contained within section 10 of the Module Descriptor guidance note).
   This will normally be variable across Schools, dependent on Programmes &/or Professional requirements.

**Equality and Diversity**

The University policies on equality and diversity will apply to this module.
In order for the student to complete this module the student will be required to view photographic image materials. Students whose vision and hearing is substantially impaired should be assessed and counselled prior to them selecting courses requiring this module.
When a student discloses a disability, a special needs advisor will agree the appropriate adjustments to be made, consulting with the module coordinator if necessary.
Diversity in cultures, backgrounds, abilities, learning and cognitive styles and individual differences are valued and appreciated. The assessments have taken this into account.

UWS Equality and Diversity Policy

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)