

ULSTER UNIVERSITY

REPORT OF A MEETING OF THE EVALUATION PANEL UNIT 16B2: MSc INTERNET OF THINGS (FT/PT) (JN)

25 May 2018

PANEL:

Dr G Breslin, Head of School of Sport, Ulster University [Chair]

Dr S Brennan, Belfast School of Architecture and the Built Environment, Ulster University

Dr E Bodanese, School of Electronic Engineering and Computer Science, Queen Mary University of London

Professor S Helal, School of Computing and Communications, Lancaster University

CHAIR OF THE COURSE PLANNING COMMITTEE

Dr J Santos, School of Computing, Ulster University

IN ATTENDANCE:

Mrs A Guarino, Academic Policy and Standards Officer, Academic Office, Ulster University

1 INTRODUCTION/BACKGROUND

The Panel met to consider the MSc Internet of Things. This is a specialist programme that has the core aim of preparing students for both an industrial career with skills in the fields of networks, sensor technologies, pervasive computing, embedded systems, signal processing, security, statistical analysis and data analytics, in addition to providing a relevant platform to embark on further research study. Students would also be able to apply the acquired skills in the development of Internet of Things (IoT) systems and applications.

The provision will be offered at the Jordanstown campus in full-time and part-time modes. Both modes of attendance will offer two points of entry in each academic year: September and January. For the September intake, the degree will normally be completed in three semesters across a single academic year in full-time mode and in 6 semesters across three academic years in part-time mode. For the January intake, the degree will normally be completed in three semesters across two academic years in full-time mode and in six semesters across three academic years in part-time mode. Both modes will comprise of six compulsory taught modules of 20 credit points each, and a final 60 credit points IoT Masters Project module in the Master's stage. A PgDip exit award exists for those exiting prior to undertaking the 60 credit point IoT Masters Project module and having successfully completed 120 credit points.

The MSc Internet of Things course will be presented for accreditation to the British Computer Society (BCS) during the academic year 2018/19, and will be seeking accreditation for Chartered IT Professional (CITP) Further Learning and accreditation as partially meeting the educational requirement for Chartered Engineer (CEng).

2 DOCUMENTATION

The Panel received the following documentation:

- Agenda and programme of the meeting;
- Guidelines for evaluation and revalidation panels;
- QAA subject benchmark statement for Master's degrees in Computing (2011);
- QAA subject benchmark statement for Engineering (February 2015);
- Reports from central University departments on Library and IT resource matters;
- Preliminary comments from panel members; and
- Course submission.

Prior to the meeting, the Panel was taken on a tour of the facilities available to support delivery of the provision by Professor Christopher Nugent, Head of School of Computing, Dr Nicola Ayre, Associate Head of the School of Computing and Dr Alan Brown, Associate Head of the School of Engineering. The Panel found the tour to be beneficial and informative and considered the facilities to be excellent, noting that the resources directed towards the student experience is evident. The Panel specifically commended the modular and interactive structure of the laboratories and teaching spaces and the rich library resources.

3 MEETING WITH SENIOR MANAGEMENT TEAM

The Panel met with Dr Michaela Keenan, Associate Dean (Education); Professor Colin Turner, Head of School of Engineering; Professor Christopher Nugent, Head of School of Computing; Dr Nicola Ayre, Associate Head of the School of Computing; Dr Alan Brown, Associate Head of the School of Engineering; and Dr Jose Santos, Lecturer in the School of Computing and the Chair of the Course Planning Committee.

3.1 Context of Provision

The Panel asked the senior team to elaborate on how the provision sits within the strategic plans and priorities of the University and the Faculty. The associate Dean (Education) explained that the Faculty of Computing, Engineering and the Build Environment has been created as a result of Ulster University's recent restructuring. The Faculty, as part of its strategic plan, has targeted a number of initiatives which have the potential of increasing non-MaSN intake, in addition to increasing the numbers of International students. As part of these initiatives, the Faculty Leadership Team considered and fully supported the provision of MSc in Internet of Things in the Jordanstown campus. The importance of offering this provision was emphasized as their flagship Master's provision, MSc Data Science, which used to be offered on both the Jordanstown and the Magee campuses, will be offered solely in the Magee campus from the next academic year.

The senior team described how the provision aligns with Ulster University's Strategic Plan 5&50 and its four areas of focus (civic contribution, academic excellence, global vision and operational excellence), highlighting the links with the local industry and the innovative research and the academic excellence of their staff. Initiatives such as the BT Ireland Innovation Centre (BTIIC), which was recently opened, was described in detail, explaining that these initiatives play a crucial role in their global research and development

capabilities, focusing on advanced research into the Internet of Things, Artificial Intelligence and Data Analytics for customer experience, among others.

The senior team explained that the School of Computing has recently undergone a revalidation process of five Undergraduate courses. This provided them with the opportunity to embrace the new Curriculum Design Principles and the new Strategic Plan 5&50. Furthermore, during this revalidation process further progression points for current undergraduate students were examined, resulting in the development of new postgraduate programmes in Computer Science, which have not been offered up to that point. As a result of this process, during the last academic year, the MSc Data Science was launched in collaboration with the School of Computing, Engineering and Intelligent Systems.

3.2 Cross School Collaboration

The Panel was assured that the School of Computing and the School of Engineering have a long history of collaboration. The senior team explained that specifically in the field of IoT, there is a need for such a collaboration as there is a blurred continuum between the two disciplines. This clear collaboration was exemplified by the structure of the course incorporating two Data Science modules, two Engineering modules as well as two Internet of things focused modules that overlap the computing and engineering disciplines.

3.3 Projected Intake

The Panel asked for clarification on the proposed student intake referring to the projected intake table provided in the document, specifically asking whether the 15 students (7 full-time and 8 part-time) expected to enrol in 2018-19 reflect only the September intake or both September and January. The senior team explained that these are only estimates based on the MSc Data Science student numbers and do not include any potential international students the provision may attract. Currently, they are optimistically estimating an intake of five international students by 2020. The senior team added that 15 students would be the minimum viable cohort size to ensure a quality student experience.

3.4 Resources and Staffing

In response to the Panel's concern regarding sustainability in case of growth in student numbers, the senior team said that resources would be in place in regards to both staffing and physical resources. The senior team assured the panel that there are plenty of laboratories, hubs and teaching spaces to accommodate any growth in numbers. In addition, the senior team highlighted that, as well as the large number of staff members already involved in the delivery of the provision, more academic staff are in the process of being recruited in both schools. Accordingly, the newly hired members of staff would enhance the existing provision, enabling a larger base to support any growth in numbers.

3.5 Resources on the Belfast Campus

The Panel expressed concern on how the move to the Belfast campus might affect the provision of the programme. The senior team expressed their belief that the move might enhance the student experience as the Belfast campus offers modern and varied hubs and interactive work spaces which would enhance student engagement. Moreover, the Schools of Computing and Engineering on the Belfast campus will be adjacent rather than separate and removed as they are in the Jordanstown campus. This would reinforce

cohesion and cohort identity, which would be vital as the provision offers two intakes a year in both full-time and part-time modes.

4 MEETING WITH THE COURSE TEAM

4.1 Provision Development

The Panel asked for the rationale in the development of the provision. The Team described the steps undertaken throughout the development process including market research and industrial consultation. The Team explained that the IoT is a niche area that is currently being developed. The course would provide students with theoretical and practical skills to enable them to satisfy the industry's need for graduates in the IoT environment. To allow for adaptability to this rapidly changing field, there would be utilisation of research informed teaching as well as facilitation of seminars and tutorials by industrial experts.

The Team explained that in addition to BTIIC guiding and informing the design of the provision, multiple industry consultations were conducted through various avenues such as participation in industry events; direct consultation with local industry during the School's Tech Talk events; and a presentation of the programme followed by a detailed discussion with the Faculty Industrial Liaison Panel.

Similar provisions across the UK were carefully reviewed. Upon examination of their specification, the Team found that the focus varied widely between either over-emphasizing computing or engineering at the expense of the other discipline. In the provision on offer the decision was made to find a balance between the two.

4.2 Curriculum Design Principles

In response to the Panel's query regarding the curriculum design principles, the Team reiterated the undergraduate revalidation process the senior team had described (refer 3.1) highlighting that the Ulster University curriculum design principles had been taken into consideration and the assessments were designed to meet the learning outcomes.

The Panel commented on the new curriculum design principles including the recommendation for four learning outcomes. The Panel was generally content with the learning outcomes presented in the programme and in the different modules apart from the six learning outcomes presented in the IoT Masters Project (COM748) querying if this could be reduced in line with the curriculum design principles. The Team clarified that as this was the final module they felt that it would be appropriate to highlight the overall learning outcomes of the project.

4.3 Educational Aims

The Panel felt that although the educational aims were articulated in a clear manner, they could be extended to additionally address IoT application space. The Panel gave the examples of smart home application development involving consumer electronics, which is anticipated to drive the personal IoT industry; emerging IoT application models and programming systems; and the theory and practice of consumer electronic design principles.

4.4 Challenge Based Learning

The Panel felt that the students would benefit from the use of challenge based learning, explaining that it is a method highly synergetic to the nature of IoT. The Panel explained that industry-sponsored competitions within the various modules and the IoT Masters Project, could pose the high level of challenge that can stimulate creativity and innovation during the course of learning.

4.5 Embedded Operating System

The Panel suggested that the use and adoption of one or two emerging IoT operating systems (e.g., ARM Mbed OS) could cut across several modules and provide a cohesive set of examples mapping IoT concepts and theoretical elements to practical implementations.

4.6 Structure of the Provision

The Panel asked for clarification regarding the structure of the provision in respect to the full-time and part-time modes of delivery. The Team explained that the design of the provision balanced the consideration given to the specific needs of both part-time and full-time students as well as the desire to create and enhance a student identity.

The Team assured the Panel that there would be a mechanism in place to assist part-time students coming from industry and outside of higher education. In addition to the assimilation offered during induction, each student would be allocated a studies advisor who would provide both academic and pastoral support. Part-time students would have the opportunity to be slowly re-introduced to higher education, enabling them to only complete two modules during the first year (one in each semester), leaving the remaining four compulsory modules to be completed in the second year. The Team admitted that this would be more difficult to achieve with the January intake.

The Team assured the Panel that there would be no prerequisite modules, and that all modules were designed as stand-alone modules, coming together when reaching the IoT Masters project. This allows for flexibility in accommodating the part-time students and the January intake.

To accommodate the part-time students, modules would be offered in the evening, between 3-9pm, beginning with a lecture followed by laboratory practice. Although, initially, classes would only be offered in the evening, it would be possible to teach the full-time mode during the day if the need arises. The Panel pointed out that this is not reflected in the course document or structure.

In response to the Panel's query regarding the provision not offering a PgCert exit award, the Team responded that this was due to the constraints caused by offering the provision in both a September and January intake, in full-time and part-time modes.

4.7 Content

The Panel discussed the content of the various modules with the Team. The Panel felt that module description and syllabi should be revised to clearly reflect the topics covered. A few examples were provided by the Panel such as LoRaWAN which was discussed in the course document but not mentioned in the modules. Other protocols and applications

relating to IoT were raised by the Panel, suggesting they be included in the syllabi and communicated to the students, such as Blockchain, and IoT stacks.

The Team assured the Panel that there was no duplication between the module IoT Networks & Security (COM744) and the module Embedded Systems & Sensors (EEE835), explaining that the former would focus on the theoretical content and the latter would be more applied, with a focus on the engineering aspect of the subject.

The Panel suggested that the topic of Security, currently included in the IoT Networks & Security module (COM744) be moved to a different module to allow the breadth of the topic of IoT Networks to be taught thoroughly, suggesting that either Embedded Systems & Sensors (EEE835) or Pervasive Computing (COM746) might be more suitable. The Team explained that they had debated where to include the Security content as only six modules are offered in the provision, as a result of the imposed constraint of the University's 20 credit point module structure. The Team acknowledged that their decision may have implications on the IoT networks topic and agreed to re-evaluate the module content after the first few offerings of the provision.

In relations to the module Big Data & Infrastructure (COM745) the Team accepted the Panel's suggestion to shift the focus of the module from Big Data to Infrastructure.

The Panel suggested that an element of art and design should be included in the programme to inform students of its importance. The Team explained that design would be discussed in the Pervasive Computing module (COM746), but agreed to enhance this by either inviting an external speaker or an internal member of staff from the Belfast School of Art to specifically discuss design principles.

4.8 Currency of Provision

In response to the Panel's query regarding the currency of the provision going forward the Team explained that the teaching and research on the provision was closely aligned with the research activity of BTIC, and was conceived and built from the ground up through collaborative consultation with industry and civic stakeholders with a strong focus on economic and societal impact. Going forward, the Team assured the Panel that the provision would be reviewed annually to ensure currency and relevance to the job market, and advised the Panel that feedback would be sought from the Industrial Liaison Panel, which includes 20 representatives from industry in Northern Ireland.

4.9 Assessment

The Panel asked for clarity regarding the process of assessment of coursework. The Team explained that, where possible, it was University policy to favour coursework over examinations, assuring the Panel that, similarly to examinations, there was a very stringent process in place in relation to assessment. As with examinations, coursework would be marked internally by the module coordinator, in the first instance, followed by an internal moderation process and finally an external moderation to ensure consistency of marking across the board. The Team assured the Panel that the assessments in each module were designed to meet the learning outcomes.

The Panel stressed the value of theoretical knowledge and queried how this would be assessed under the new assessment strategy. The Team gave the example of the Pervasive Computing module (COM746) in which students, as part of their coursework,

would be required to provide a 20-minute presentation of their project, explaining that this would provide an opportunity to assess theoretical knowledge and understanding.

The Team added that theoretical knowledge would also be displayed through the students' case studies, which would be submitted in the form of research and are expected to demonstrate theoretical knowledge. If needed, the students could also submit supplementary material to cover the breadth of the project in addition to distilling the paper for potential publication.

The Team agreed that there should be a balance of both application and theory and agreed to examine this at a modular level.

The Panel queried how individual contribution to group projects would be assessed. The Team agreed that assessing individual students within group projects was challenging and explained that this would be addressed by breaking down the marks to individual performance.

The Team agreed to review the timing of the assessment in the IoT Networks & Security (COM744) module after the Panel highlighted that both assessment elements would be completed by week 8, querying how the students would be kept engaged beyond that point.

4.10 Student Support

In response to the Panel's query regarding attendance monitoring and enforcement, the Team explained that although not mandatory, within the undergraduate provision, there is a detailed system in place for carefully monitoring attendance, explaining that attendance is noted for all lectures and tutorials to identify students who need targeted attention, encouragement or pastoral support. This system of close monitoring would easily be mirrored in the IoT provision with an estimated cohort of only 15 students. The Team added that each student would be allocated a studies advisor who would provide both academic and pastoral support.

4.11 Graduate Qualities and Student Experience

In response to the Panel's query regarding graduate qualities and student experience, the Team explained that the provision was developed with a view to deploying the Ulster Learning Model reinforcing graduate qualities and within it addressing student learning experience principles. Graduates of the programme would acquire specialised knowledge and practical skills as well as transferable skills such as team work and presentation skills, making the graduates highly employable.

The Panel was advised that when designing the provision, the Team took a student centred approach, conscientious of the need to build a cohort identity. Learning and teaching strategies built into the modules included activities specially designed to enable learning as well as enhancing cohort cohesion by encouraging group work. The use of evening seminar events was also noted as a way of enhancing cohesion and inclusivity.

5 CONCLUSIONS

The Panel commended the team on the following aspects evident from the validation:

- The well prepared document, evidencing clear collaboration across the schools in the development of the programme;
- The consultation process used to inform the design of the course, including excellent employer engagement and consultation with students;
- The programme being linked to Ulster University strategies, such as the Learning and Teaching strategy;
- The flexible delivery model involving collaboration of multiple schools and academic staff members as well as the blended learning feature and the full/part-time flexibility, which allows the programme to draw from a broad set of expertise and is likely to appeal to a diverse range of learners, including professionals, seeking up-skilling in the area of Internet of Things;
- The resources and learning environments available to students, such as the on-site library and laboratory facilities;
- The strong links with research and staff expertise ensuring research informed curriculum and teaching; and
- The programme being designed with accreditation in mind.

The Panel agreed to recommend to the Academic Standards and Quality Enhancement Committee that the programme be approved for a period of five years (intakes 2018/19 to 2022/23 inclusive) subject to the conditions and recommendations of the Panel being addressed and a satisfactory response and a revised submission being forwarded to the Academic Office **by 29 June 2018** for approval by the Chair of the Panel.

Conditions

- i) All issues identified by the Academic Office and detailed in the appendix to the Panel report are addressed.

Recommendations

- i) That the structure of the full-time and part-time programme be reviewed and revised where necessary; and further clarification provided in respect of the delivery of both modes.
- ii) That consideration be given to comments of the Panel on curriculum content, and further detail be added to the syllabi and module descriptions in line with the discussion with the Panel.
- iii) That consideration be given to including challenge based learning in the IoT Masters project by engaging industry sponsored competitions.
- iv) That clarification be provided in relation to methods of assessing theoretical knowledge in the various modules.
- v) That clarification be provided on how individual contribution to group projects would be assessed (refer Module EEE834 Digital Signal Processing).
- vi) That similar facilities and teaching spaces be made available to the students following the anticipated move to the Belfast campus.

6 APPRECIATION

The Chair thanked the Panel members and, in particular, the external members, for their valuable contribution to the validation process.