Course COMP6324: IoT Service Design and Engineering

Course Summary

IoT is an emerging technology that will transform business and societies across the world.
Similar to AI, mobile or Cloud it will have a profound impact on the existing technology landscape, customer experience, operational processes and business models.
This course provides an overview of the topic from a business and technology perspective and allows the students to experience the full lifecycle of IoT, from the overall corporate strategy to the actual implementation of an IoT application.
This course is a project-based course and its design is based on the action-learning concept used at MIT and Harvard and the course design has been reviewed by professors at MIT and Harvard.

Assumed Knowledge

The students should be familiar with at least one modern programming language like C, C#, Java, PHP or Python.
At least high-level understanding of databases, Cloud and network technologies is necessary to achieve the course aims. In the absence of this understanding, students are advised to do appropriate reading before and/or after starting the course.
A high-level understanding of architecture and solution design is helpful for the assessments. Again, if this understanding is not in place, appropriate reading before and/or after starting the course is required.

Course Aims

The course aims to provide the students with a holistic understanding of IoT from a business and technology perspective and help them understand what potential career options are.

Learning outcomes

After completing this course, students will be able to:

- Be familiar with IoT terminology
- Understand the impact of IoT on selected industries
- Acquire knowledge on IoT strategy and architecture
- Create an IoT application
- Select potential career options

Teaching Approach

Lecture

The lectures provide the necessary theoretical knowledge for the project work and course assessments. The students are encouraged to discuss the lecture content with their assigned industry mentors, as well as the lecturer.

The learning for the lectures is assessed through a quiz and assignment. The quiz and assignment templates can be found on Piazza.

Project

The students need to form teams of 3-5 individuals in week 1 of the course. They then choose a business problem to solve as project assignment, from a list provided on Piazza. Every business problem has an associated industry mentor that is working with the teams to understand the business problem and create an IoT application. The teams are required to reach out the industry mentors them before the week 2 lecture to confirm availability and ways to engage, as some Industry Mentors may not be able to be on site and a remote collaboration setup is required.
Student teams are responsible for setting up weekly (virtual) meetings with the Industry Mentors. The role of the Industry Mentor is to provide their idea, expertise, experience and industry insights. The Industry Mentors are committed to spend around one hour per week with the student teams.
Besides creating an IoT application, the student teams need to present their solution in the last lecture and will be judged by a panel of IoT industry experts. The winning team will receive a price from an industry sponsor. The Industry Mentors can potentially help the teams during the course also with creating a compelling presentation. Otherwise the UNSW Enterprise and the MCIC that provide support to start-ups, are able to support teams with their presentations. Please reach out to Laura Earl (laura.earl@unsw.edu.au). Each presentation is limited to 5 minutes.

The MCIC has also offered the student teams to conduct face to face session in their maker/event space. Please ask Laura Earl at MCIC about room availability.

The project has the following deliverables:

- An IoT strategy, that describes the business problem and selected IoT strategy components needed to solve the challenge. An IoT Strategy template will be provided on Piazza.
- An IoT architecture, that describes the solution to the business problem from a conceptional/logical perspective, without any reference to specific technology products. An IoT Architecture template will be provided on Piazza.
- An IoT solution design, that describes the solution, using the selected products. An IoT Solution Design template will be provided on Piazza.
- The code and executable of an IoT application that will be stored on GitHub. The Student Mentor will provide the relevant links.
- A pitch deck for the IoT application.

The students are free in their choice of technologies and hardware/software product for the IoT application. Some Industry Partners are providing IoT solution components together with technology coaches. A list can be found on Piazza.

The IoT application needs to have the following solution component:

- A physical IoT device, sensor board or asset with sensors
- A connectivity/network from the IoT device to an IoT platform
- An IoT platform that ingest, stores and visualised the IoT sensor data
- Integration into a simulated business system (CRM, ERP, EAM, SCM, etc.)

Course Schedule

Week	Date/Time	Location	Module	Form	Assignment
1	18.02.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle	Lecture: - IoT 101 (1:30) - "How to create a compelling pitch deck" (1:00) Project: - Teambuilding (0:30)	Lecture Videos	IoT 101 Quiz
	19.02.20 – 24.02.20	K-E15-1043 - Quadrangle or project team organised location		Project	Team building, business problem selection, contact industry mentor Watching Industry Impact Videos
2	25.02.20 | 6:00-7:30pm	K-E15-1043 - Quadrangle		Lecture	

	25.02.20 | 7:30-9:00pm	K-E15-1043 - Quadrangle or student project team location	IoT Strategy & IoT Application Development	Project	Industry Mentor session (Understand business problem) IoT Strategy Draft
	Project team organised	project team organised location			
3	3.03.20 | 6:00-7:30pm	K-E15-1043 - Quadrangle	IoT Architecture & IoT Application Development	Lecture	
	3.03.20 | 7:30-8:30pm	K-E15-1043 - Quadrangle or student organised location		Project	Industry Mentor session (Present IoT Strategy Draft)
	Project team organised	Project team organised location			IoT Strategy v1.0 IoT Architecture Draft
4	10.03.20 | 6:00-7:30pm	K-E15-1043 - Quadrangle	IoT Solution Design & IoT Application Development	Lecture	
	10.03.20 | 7:30-9:00pm	K-E15-1043 - Quadrangle or project team organised location		Project	Industry Mentor session (Present IoT Architecture Draft)
	Project team organised	project team organised location			IoT Architecture v1.0 IoT Solution Design Draft
5	17.03.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle or project team organised location	IoT Application Development	Project	Industry Mentor session (Present IoT Solution Design Draft)
	Project team organised	Project team organised location			IoT Solution Design v1.0 IoT Application prototype IoT Project Pitch Draft
6	24.03.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle or project team organised location	IoT Application Development	Project	Industry Mentor session (Present IoT Pitch Draft)
	Project team organised	Project team organised location			IoT Project Pitch V1.0 IoT Application prototype
7	31.03.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle or project team organised location	IoT Application Development	Project	Industry Mentor session (Present IoT Application prototype)
	Project team organised	Project team organised location			IoT Application v0.5
8	7.04.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle or project team organised location	IoT Application Development	Project	Industry Mentor session (Present IoT Application v0.5)
	Project team organised	Project team organised location			IoT Application v0.9
9	14.04.20 | 6:00-9:00pm	K-E15-1043 - Quadrangle or project team organised location	IoT Application Development	Project	Industry Mentor session (Present IoT Application v0.9)
	Project team organised	Project team organised location			IoT Application v1.0
10	20.04.20 | 6:00-7:30pm	MCIC - MakerSpace	IoT Project Pitches	Project	Judging by IoT Career Panel 5 minutes pitch + 5 minutes Q&A by panel

	20.04.20 | 7:30-9:00pm		IoT Career Panel	Lecture	Reflection Paper

Industry Panel

The last class is an industry panel, with people from different kinds of organisations. The panel will discuss IoT careers and through the diversity of the panellist, students will see the breadth of career options in IoT. The industry panel is moderated by the CEO of the IoT Alliance Australia.

Assessment

The course assessment consists for 4 deliverables that are described below. More detailed will be realised on Piazza on due time.

The Course Admin assigns one Student Mentor in week 2 to each student and student team for support with the course information, assessments and collaboration infrastructure "Piazza". She/He will answer any question in relation to the assignment and to mark the assignments.

IoT 101 Quiz (10%)

Asks questions on the presented content in the lectures

- Has to be submitted on Piazza until Friday, 22.02.20, EOD
- The IoT Quiz is an individual assignment.
- A template can be found on Piazza

Marking criteria:

Answers to the questions are either right or wrong. Each question is worth 1 point = 1% of the final mark.

IoT Solution Documentation (30%)

- Asks the student teams to create an IoT solution documentation that is the basis for the IoT Application the students implement
- The IoT Solution Documentation has 3 parts: IoT Strategy, IoT Architecture and IoT Solution Design
- The submission week for draft and final deliverable of the 3 parts is called out in the course schedule above. Submission on Piazza needs to happen on the day before the next lecture or, in weeks without lecture, on a Friday.
- The IoT Solution Documentation is a deliverable created by the student teams.
- A template can be found on Piazza
- It counts for 30% of final mark
- Each part is evaluated separately and counts 10% to the final mark

Marking criteria – IoT Strategy:

- Full (10 points): The IoT strategy documentation contains all sections in the template. The industry mentor confirms to the Student Mentor that the documented IoT strategy addresses the business challenge/opportunity and context. The assignment is handed in in-time.
- If the IoT strategy does not address the business challenge/opportunity, 5 points are deducted.
- If the IoT strategy does not cover all sections in the template, 5 points are deducted.
- If the assignment is handed in late 5 points are deducted.
- 0 points is the lower limit

Marking criteria – IoT Architecture:

- Full (10 points): The IoT architecture documentation contains all sections in the template. The industry mentor confirms to the Student Mentor that the documented IoT strategy addresses the business challenge/opportunity. The assignment is handed in in-time.

- If the IoT architecture does not address the business challenge/opportunity, 5 points are deducted.
- If the IoT architecture does not cover all sections in the template, 5 points are deducted.
- If the assignment is handed in late 5 points are deducted.
- 0 points is the lower limit

Marking criteria – IoT Solution Design:

- Full (10 points): The IoT Solution Design documentation contains all sections in the template. The industry mentor confirms to the Student Mentor that the documented IoT solution design addresses the business challenge/opportunity and context. The assignment is handed in in-time.
- If the IoT solution design does not address the business challenge/opportunity, 5 points are deducted.
- If the IoT solution design does not cover all sections in the template, 5 points are deducted.
- If the assignment is handed in late 5 points are deducted.
- 0 points is the lower limit

IoT Application Implementation (40%)

- Asks the student teams to create an IoT application based on the solution design for the business problem they have chosen
- The student teams are free in their choice of technologies and products. Industry sponsors have agreed to provide hardware and/or software, as laid out earlier in this document. The teams get access to the technology vendors via their assigned Student Mentor.
- There will be technology coaches from industry partners available, if the project team decides to choose products/technologies provided by an industry partners.
- The code for the solution has to be submitted on GitHub. The IoT Solution Design needs to contain a link to the relevant GitHub folder. Each team will get their own GitHub folder and the URL will be provided by the Student Mentor or Course Administrator.
- The source code and a running application for each version needs to be on GitHub the day before a specific version is presented to the Industry Mentor according to the course schedule.

Marking criteria:

- Full (40 points): All parts of the documented IoT Solution Design are implemented. The code is available in GitHub in-time. The Industry Mentor confirms to the Student Mentor that the business problem would be solvable with such a solution. The source code has inline documentation and a link back to the relevant sections of the IoT solution design. A physical IoT device/sensor board is used. An IoT networking technology is used. The application and data sit on an IoT Platform. A business system simulator is part of the solution.
- Only part of the solution design is implemented: 10 points deducted
- Code is not available on GitHub in-time: 5 points deducted
- Solution does not address the business challenge/opportunity: 10 points deducted
- No link back from code to solution design documentation: 5 points deducted
- No physical IoT device/sensor board is used: 10 points deducted
- No IoT networking technology is used: 5 points deducted
- Data and application do not sit on an IoT platform: 10 points deducted
- No business system simulator is used: 5 points deducted.
- 0 points is the lower limit

IoT Project Pitch (10%)

- Ensures that students learn how to position IoT solutions to users in a compelling way.
- Current version is on “Piazza” on the day it is presented to the judging panel.

Marking criteria:

- Full (10 points): IoT Project Pitch presented at last lecture. All team members are present at last lecture to answer questions of the judging panel.
- Not all team members are at the IoT Career Panel: 5 points deducted
- Project Pitch not presented at IoT Career Panel: 10 points deducted
- 0 points is the lower limit

Course Participation (10%)

- Ensures that everyone has the opportunity to follow the lectures and everyone in the team contributes to the assessment.
- Student Mentors keep track of the participation.

Marking criteria:

- Full (10 points): Individual student was in each lecture and each meeting with the Student Mentor and Industry Mentors. The individual reflection paper is submitted on Piazza in-time.
- Missed more than 2 project team meetings (without doctors' letter): 5 points deducted
- Reflection paper is not submitted: 10 points deducted.
- Reflection paper has less than a 1 A4 page (12-point font): 5 points deducted
- 0 points is the lower limit

Mapping from outcomes to assessment

Assessment / Learning Outcome	IoT Quiz	IoT Solution Documentation	IoT Application Implementation	IoT Project Pitch	Reflection Paper
Be familiar with IoT terminology	X				X
Understand the impact of IoT on selected industries	X				X
Acquire knowledge on IoT strategy and strategy	X	X			
Understand the security risk of IoT	X	X	X		
Create an IoT application		X	X	X	
Select potential career options				X	X

Student Conduct Statement

The **Student Code of Conduct** (Information , Policy) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer , Grievance Officer , or one of the student representatives.

Academic Honesty and Plagiarism

Plagiarism is defined as using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity
- UNSW Plagiarism Procedure

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism

The pages below describe the policies and procedures in more detail:

- Student Code Policy
- Student Misconduct Procedure
- Plagiarism Policy Statement
- Plagiarism Procedure

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students

Course staff details

A/Senior Lecturer: Peter Klement, p.klement@unsw.edu.au
Course Admin: Mortada Al-Banna, m.al-banna@unsw.edu.au
MCIC contact: Laura Earl, laura.earl@unsw.edu.au
Student Mentors: Ask Course Admin
Industry Mentors: Listed on Piazza in the list of available business challenges.
Technology Mentors: Listed on Piazza in the list of available IoT technologies.