COMP6733 Internet of Things Design Studio

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Course staff

	Lecturer-in-charge	Lab demonstrator	Lab demonstrator	Lab demonstrator
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Office	Room 606, Building K17	Room 401, Building K17	Room 401, Building K17	Room 401, Building K17
Consultation hours	Monday 14:30-15:30 Note: Consultation hours are subject to change. Any changes will be announced on course website.			

General course information

Units of Credit	6 Note: This signifies 33% of a full-time study load for one term and at least 14 hours of work per week.
Pre-requisites / Co-requisites	65 WAM and COMP9331 or COMP3331 (Computer Networks and Applications)

Assumed knowledge	• Computer Networks: Layering, Medium Access Control, Routing and Transport layer
	• Good familiarity with Linux
	• Math knowledge from core courses:
	  ◦ Probability and statistics
	  ◦ Graph Theory and algorithms
	  ◦ Calculus
	  ◦ Linear algebra
	• Familiarity with a high level programming language such as Java and Python, **AND** a low level programming language such as C, **AND** microcontroller programming

Learning and teaching philosophy	The course consists of the following learning components: • Lecture of 2 x 2 hours per week • Guided laboratory work for 2 hours per week in Weeks 1-5. • Internet of Things project The aim of the lectures is to facilitate learning and understanding of the important concepts within the course syllabus. Lecture notes will be available at the course web site for downloading before the lecture. In addition to attending the lectures (**mandatory**), students are also asked to study the recommended reading materials before and after the lecture. A number of study problems will be issued each week. These problems give the students a chance to test whether they have understood

	concepts that are introduced in the lecture. Time in the lecture, if available, may be used to discuss some of these study problems. Solutions to these problems will be available on the course web site. This course will also provide practical training on programming Intenet of Things (IoT) devices. Each student will be loaned at least one IoT device during the duration of this course for them to work on the laboratory exercises and project. Guided laboratory on IoT programming will take place from Weeks 1-5 for 2 hours per week. Laboratory worksheet in self-study style will be issued on the course web site. A laboratory demonstrator will be available to help students with their work. Each laboratory exercise comes with an assessment exercise. Students are expected to demonstrate the assessment to their laboratory demonstrators in the next lab session in order to receive the allotted marks for the exercise. The aim of project is to give students an opportunity to work on an extended development IoT project. The project work will be done in teams of up to 3 students.
Course aims:	Students will learn the fundamental principles behind designing IoT. Topics include a selection from: IoT technology and services, IoT system architecture, Low Power communications (Bluetooth Low Energy and 6LoWPAN) and security issues, time synchronisation and localisation, sensor data smoothing and filtering, light-weight machine learning and data fusion, inertial sensing, activity recognition, biometric authentication and cloud services.
Learning outcomes	Students successfully completing this course will have a working knowledge of the topics on IoT covered, and will be able to demonstrate their knowledge both by describing aspects of the topics and by solving problems related to the topics. They will have practical experience with the topics covered in the laboratory exercises and project undertaken.

Assessment

There are altogether 3 assessment components as listed in the table below.

Assessment components	Details	Weighting
Laboratory	5 Laboratory assessment exercises See Laboratory section for details.	30%
Problem Sets	Problem set 1: Issue in Week 4 and submit by Week 9	10%
Project (Research, presentation, practical work, reports and demo)	Project plan and preliminary founding class presentation (Week 5) Report by Friday (Week 5)	15%
	Project milestone 2 class presentation (Week 8) Report by Friday (Week 8)	15%
	Project final report (10%) and demo (20%) Report and code due 17:00 Sunday 24 Nov 2019. Demo date: Monday 25 Nov 2019, to be negotiated with the LiC.	30%

The following assessment rules apply:

1. You must attempt all assessment components.
2. Your raw score is computed as the weighted sum (with the weightings listed above) of the score for each assessment component.
3. Your final score will be computed according to the following rules:
    a. If you obtain 40% or more for all three assessment components, your final score equals to your raw score.
    b. If you obtain less than 40% for any one of the three assessment components, your final score is the smaller of your raw score and 64. For example,
        i. If at least one of your assessment components is less than 40% and your raw score is 70, your final score will be 64.
        ii. If at least one of your assessment components is less than 40% and your raw score is 50, your final score will be 50.

Late submission of any form of assessments: Assessments submitted late are subject to the following penalty: the maximum mark obtainable reduces by 10% per day late. Thus if the assessment is marked out of 10, and students A and B hand in assessments worth 9 and 7, both two days late, then the maximum mark obtainable is 8, so A gets min(9, 8) = 8 and B gets min(7,8) = 7. Assessments handed in over 5 days late will receive no marks.

Assessment submission: Assessment submission procedure is described in the assessment specification document, which will be linked to this page when the assessment specification becomes available. Generally assessments are submitted electronically using the *give* program running on the School's computer systems (in labs, and on servers). Details will be given in the assignment specifications. You may sometimes be asked to submit a hard copy of your assignment. Again, details will be in the assignment specification.

Supplementary Assessment: UNSW policy on special considerations is here. Since there is no final exam for this subject, no supplementary exam will be available. If students experience serious misadventures or sickness then they are asked to discuss these issues as soon as they

arise with the LiC.

Note on Parallel Teaching: The course will be attended by both undergraduate and postgraduate students. Note that the expectations on the postgraduate students will be higher. The Class Test for postgraduate students will contain questions of a higher standard. They are also expected to present more difficult papers in the seminar and their reports will also be expected to be of a higher standard.

You should also read the course policy on Student Conduct

Course and laboratory schedule

The course will meet Monday 16:00 - 18:00 in Tyree Energy Technologies Building (TETB) LG07 (K-H6-LG07) and Thursday 12:00 - 14:00 in Law Theatre G02 (K-F8-G02)for lectures.

You should have already signed up one of these laboratory groups. Guided laboratory will take place in Weeks 1-5.

Lecture and laboratory schedule: (the order and content shown below may vary - this is an indication only. Any changes will be announced in the course website.)

Week	Date	Lecturer	Lecture topic	Laboratory	Remarks
1	16, 19 Sept	Wen	Course organisation Introduction to Internet of Things (IoT) and Foundation topics on IoT	Getting started and Contiki fundamentals (Assessment to be demonstrated in the next lab)	You will be loaned a SensorTag in your laboratory sessions. List of projects posted.
2	23, 26 Sept	Wen, Guest lecturer	Low Power Communications: IEEE 802.15.4, Bluetooth Low Energy WBS Tech smart building (RPL, 6LoWPAN)	Networking I (Assessment to be demonstrated in the next lab)	
3	30 Sept, 3 Oct	Wen, Guest lecturer	LPWAN, CoAP, Web Services for Internet of Things WiseTech (product end goal, embedded devices, sensor design choice, communication and devOps, IoT middleware.)	Networking II (Assessment to be demonstrated in the next lab)	Project teams and topics finalised
4	10 Oct	Wen	Time synchronisation and Localisation	CoAP, Web services, and sensors (Assessment to be demonstrated in the next lab)	Problem Set Released
5	14, 17 Oct	Wen	Project presentation (I)	RF Ranging/Localisation (Assessment to be demonstrated in Week 7)	Project Plan Due
6	21, 24 Oct	Wen	Session break (Catch up week)		
7	28, 31 Oct	Wen, Guest lecturer	Light-weight machine learning and Signal Processing Yonomia Asset tracking	Note: No laboratory exercise this week. Marking of laboratory assessment given in Week 5.	
8	4, 7 Nov	Wen	Project presentation (II)		Intermediate Project Report Due
9	11, 14 Nov	Wen	Project work		Problem Set Due
10	18, 21 Nov	Wen, Guest lecturers	CSIRO (animal tracking IoT systems) UNSW BioMedical Engineering (ubiquitiously diabetes monitoring with smartphones) Inkerz (smart digitisation with embedded cameras)		Final Project Report due on 17:00, 24 Nov, Sunday.
11	25 Nov	Wen	Project demo and interview		Return all equipment at the end of project demo and interview.

Student resources:

IoT is a young, emerging and rapdily evolvinf field. Thus, the course materials will draw from books, professional journals and conference papers.

You will find the following books in the library to be of interest:

- Bahga and Madisetti, Internet of Things: A Hands-On Approach
- McEwen and Cassimally, Designing the Internet of Things

We will be using a number of journal or conference papers in this course. These will be provided on the course web site and you can access them using your zpass.

Guided laboratory and laboratory assessment:

Students are required to attend a guided laboratory from Weeks 1-5 where they will learn programming IoT devices. Laboratory worksheets will be available on the course website. There will be a lab demonstrator assisting in the laboratory.

The equipment to be used is the SensorTag. Each student will be loaned one SensorTag for doing the laboratory and the project. The students will need to sign a loan form and undertake to return these motes in good condition. The motes will be handed out in the laboratory session in the first lab. You must return them at the end of your project demo and interview.

The first lab will provide a basic overview of Contiki and SensorTag. Each lab has an assessment exercise that comes with it. You are given a week to complete these exercises and you will need to demonstrate this to the lab demonstrator in the next laboratory session. Although there is no laboratory exercise for Week 7, you will still need to attend the laboratory to do the demonstration. Each lab exercise is worth 5 - 7 marks.

Projects:

The aim of the project is to give the students an opportunity to do a small research and development project in IoT. The project work is to be performed in teams of 3 students.

The *modus operandi* is:

- A list of projects will be made available in Week 1 of the course.
- Students can form teams to bid to do one of these projects or propose their own. Future details on this will be available when the list of project is posted.
- Project teams and topics must be finalised by Week 3.
- Each project team should submit their preliminary research finding and proposed project plan in a preliminary report in Week 5. The proposed project plan must include the milestones to be achieved by Week 8 and final deliverables. The LiC reserves the right to add or remove tasks from the proposed project.
- Each project team is to present their preliminary research finding to the class during the lecture in Week 5.
- Each project team to present their intermediate finding (demonstrating milestones achieved as per preliminary plan) in Week 8.
- The final project report and code is to be submitted by 17:00 Sunday 24 Nov 2019 via *give*.
- A final demonstration and interview will be held in Week 11.

Note that there is no formal examination for COMP6733.

Communications via e-mail

1. You should check your school e-mail frequently in case of announcements relating to this course. We assume that you read e-mail sent to your UNSW account by the next working day during teaching sessions.
2. Students must follow the proper communication channels:-
    a. The official course mailing address (cs6733@cse.unsw.edu.au) should only be used for students who have personal problems and wish to seek help from LIC or Administrator on confidential basis. Please allow up to a week to receive a reply but we will attempt to reply sooner. If it's urgent, use the consultation hours. For administrative or technial questions, we urge you to use the course forum. You can expect a quick response from the teaching team.
    b. We prefer that you email us using your UNSW email account. If you are e-mailing us from a non-UNSW e-mail account (such as gmail, yahoo, etc), you must include **your full name and student number** in the e-mail to enable us to identify you, otherwise we will **not reply** to your email.
    c. Do not send direct emails to LIC, Administrator, etc. via their personal email addresses. Emails received at private accounts **will not be read and automatically deleted without reply.**

Student Conduct

Copying assignments is unacceptable. Assignments will be checked. The penalties for copying range from receiving no marks for the assignment, through receiving a mark of 00 FL for the course, to expulsion from UNSW (for repeat offenders). Allowing someone to copy your work counts as plagiarism, even if you can prove that it is your work.

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.

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

Continual course improvement

Student feedback on this course, and on the lecturing in this course, will be gathered via questionnaires held at or after the end of the course. Student feedback is taken seriously, and continual improvements are made to the course based in part on this feedback. The course questionnaire results go to the Head of the School of Computer Science and Engineering, who reads the results and follows up in cases where action is clearly needed.

The project has been turned into a research and development project to give the students an opportunity to define their own project. We have also updated the sensor hardware to SensorTag as they have wide applicability in the emerging Internet of Things.

Further information

- Students enrolled in COMP6733 are expected to attend all classes
- The use of School of Computer Science and Engineering computing laboratories is subject to rules described on this page. This page also outlines what to do in case illness or misadventure that affects your assessment, and supplementary examinations procedures within the School of Computer Science and Engineering.
- Information on UNSW Occupational Health and Safety policies and expectations
- Diversity issues