COMP8294

Embedded IoT Hardware System and Devices

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Computing

Contents

General Information

Unit convenor and teaching staff
Convenor and Lecturer
Endrowednes Kuantama
endrowednes.kuantama@mq.edu.au
Contact via Email
4RPD, 360
Thursday, 1-3 PM

Credit points
10

Prerequisites
COMP6291

Corequisites

Co-badged status

Unit description
Unlike traditional computer-based systems, IoT devices are “embedded” within other devices to provide enhanced functionality without exposing the user to the complexities of a device. This unit investigates the hardware components of IoT-based Embedded System devices such as microcontrollers, Input/Output interfaces, display and memory, power supply and communication ports. This unit will also examine the architecture, design methodology, and trade-offs of architectures in IoT-based embedded devices.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals (UNSDGs) Industry, Innovation and Infrastructure

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Apply knowledge of major components of embedded systems to design real-time embedded system hardware and low-powered IoT devices and sensors.

ULO2: Evaluate, performance-test, and debug IoT-based embedded system hardware

architectures and devices using various simulation tools.

ULO3: Demonstrate knowledge of, and program, microcontroller architecture.

ULO4: Analyse and evaluate different embedded hardware architectures and algorithms.

ULO5: Learn and apply knowledge of trusted embedded hardware architecture to secure embedded hardware.

General Assessment Information

In this unit, students are encouraged to engage actively in their learning through a multifaceted approach. Attending lectures consistently, taking comprehensive notes, and actively participating in discussions are vital components of this active participation. Regular attendance at workshops and practical sessions is emphasized, and students are advised to seek instructor feedback to enhance their understanding of assignments. Pursuing excellence in assignments is a fundamental expectation, requiring thorough preparation to showcase a firm grasp of the content and meet prescribed standards. Additionally, students are urged to engage actively with assigned readings, supplementing their notes and formulating thoughtful questions for further clarification during discussions with lecturers. Thoughtful responses to workshop questions, demonstrating a deep understanding of the material, and contributing meaningfully to discussions are also highlighted. Furthermore, timely completion of assigned tasks or simulation projects within given timeframes is essential for successfully and punctually fulfilling unit requirements. Overall, this holistic approach aims to ensure students actively contribute to and excel in various aspects of their learning experience in the unit.

Participation Guidelines:

- Active Engagement: Attending most classes is strongly recommended, actively participating in discussions by asking and answering questions and contributing perspectives from personal backgrounds and workplaces.
- Utilization of Supplementary Resources: Supplementary resources, including lecture materials and digital recordings available through Echo360 via iLearn login, are accessible for review purposes and in case of missed lectures. However, it is essential to note that these recordings should not be solely relied upon, and copyrighted material may be excluded.
- Effective Out-of-Class Communication: iLearn is the primary platform for effective out-of-class communication and engaging in discussions on various topics. Accessible at http://ilearn.mq.edu.au, iLearn provides forums for active participation and is a valuable resource for information dissemination. Regularly reviewing iLearn and conducting background reading before each class is highly encouraged to enhance your overall learning experience.

Assignment Submission

Your assignment is to be submitted online using iLearn.

Release Dates

- Assignment 1 (I/O Data Processing in Embedded IoT Hardware): To be released no later than 16th August.
- Assignment 2 (Applications of Embedded IoT Hardware): To be released no later than 20th September.

Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern. For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration.

For example, if the assignment is worth 8 marks (of the entire unit) and your submission is late by 19 hours (or 23 hours 59 minutes 59 seconds), 0.4 marks (5% of 8 marks) will be deducted. If your submission is late by 24 hours (or 47 hours 59 minutes 59 seconds), 0.8 marks (10% of 8 marks) will be deducted, and so on.

Assessments where Late Submissions will be accepted

- Assignment 1 (I/O Data Processing in Embedded IoT Hardware) - YES, Standard Late Penalty applies
- Assignment 2 (Applications of Embedded IoT Hardware) - YES, Standard Late Penalty applies
- Lab report - YES, Standard Late Penalty applies

Generative AI Open Assessments

The use of generative AI tools is permitted for assignments in this unit when used to support learning and understanding. Students are expected to use these tools to assist with exploring ideas, improving their understanding of concepts, or obtaining feedback, rather than as a substitute for completing the assessment themselves.

Where generative AI is used:

- Any use of generative AI must be appropriately acknowledged in the report in accordance with the unit's referencing requirements.

- AI-generated images may be used for general illustrations where appropriate. However, technical content such as system schematics, flowcharts, software architecture diagrams, algorithms, and source code must be created by the student.
- All written explanations, technical discussions, analysis, and conclusions must reflect the student's own understanding.
- The submitted source code should follow the programming practices and coding style presented in the lectures. Students are expected to understand every aspect of their implementation.
- During demonstrations or presentations, students may be asked to explain their design decisions, algorithms, and source code. Assessment will consider both the submitted work and the student's ability to demonstrate their understanding of it.

Students are responsible for ensuring that all submitted work complies with the University's Academic Integrity Policy and accurately represents their own knowledge and understanding.

Requirements to Pass this Unit

In this unit, the final mark will be calculated by combining the marks for all assessment tasks according to the percentage weightings shown in the assessment summary. Concretely, in order to pass the unit, you must obtain an overall total mark of 50% or higher. Students obtaining a higher grade than a pass in this unit will (in addition to the above): have a total mark of 85% or higher to obtain High Distinction; have a total mark of 75% or higher to obtain Distinction; have a total mark of 65% or higher to obtain Credit. This unit does not have hurdle assessments.

Special Considerations and Short Extensions

Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable, and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through connect.mq.edu.au/.

Short Extensions

All assessments are eligible for an automatic short extension. You can only apply for an automatic short extension before the due date.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
I/O Data Processing in Embedded IoT Hardware	40%	No	13/09/2026	Individual	Yes	Open
Applications of Embedded IoT Hardware	40%	No	25/10/2026	Individual	Yes	Open
Lab report	20%	No	08/11/2026	Individual	Yes	Open

I/O Data Processing in Embedded IoT Hardware

Assessment Type [1]: Experiential task
Indicative Time on Task [2]: 37 hours
Due: **13/09/2026**
Weighting: **40%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Students will develop code for an IoT application, focusing on efficient I/O data processing and performance optimization. A technical report documenting implementation, testing, and performance evaluation is required.

On successful completion you will be able to:

- Apply knowledge of major components of embedded systems to design real-time embedded system hardware and low-powered IoT devices and sensors.
- Evaluate, performance-test, and debug IoT-based embedded system hardware architectures and devices using various simulation tools.

Applications of Embedded IoT Hardware

Assessment Type [1]: Portfolio
Indicative Time on Task [2]: 37 hours
Due: **25/10/2026**
Weighting: **40%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Students will apply their knowledge of embedded system components to design real-time

embedded hardware and low-power IoT devices and sensors. A technical report documenting the design, implementation, and performance evaluation is required.

On successful completion you will be able to:

- Apply knowledge of major components of embedded systems to design real-time embedded system hardware and low-powered IoT devices and sensors.
- Evaluate, performance-test, and debug IoT-based embedded system hardware architectures and devices using various simulation tools.
- Demonstrate knowledge of, and program, microcontroller architecture.
- Analyse and evaluate different embedded hardware architectures and algorithms.
- Learn and apply knowledge of trusted embedded hardware architecture to secure embedded hardware.

Lab report

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 24 hours
Due: **08/11/2026**
Weighting: **20%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

This lab offers practical experience with embedded IoT systems. Students will complete hands-on tasks and submit a report at the end of the session, which will be assessed on technical accuracy, clarity, and formatting.

On successful completion you will be able to:

- Apply knowledge of major components of embedded systems to design real-time embedded system hardware and low-powered IoT devices and sensors.
- Demonstrate knowledge of, and program, microcontroller architecture.
- Analyse and evaluate different embedded hardware architectures and algorithms.
- Learn and apply knowledge of trusted embedded hardware architecture to secure embedded hardware.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- Academic Success for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation.

[3] An automatic short extension is available for some assessments. Apply through the Service Connect Portal.

Delivery and Resources

Delivery Time

COMP8294 consists of both lectures and workshop sessions. Lectures are held every Wednesday from 1:00 PM to 3:00 PM, commencing in **Week 1**. Workshop sessions take place onsite every Wednesday from 4:00 PM to 6:00 PM, starting in **Week 2.**

Lectures

COMP8294 lecture sessions explore embedded IoT hardware systems in-depth, blending theoretical concepts, embedded design, mobile programming, and hands-on applications. The focus extends to practical implementation, particularly embedded IoT simulator software and embedded IoT hardware based on NodeMCU8266 microcontroller, intelligent sensors, and IoT platform, to provide students with a comprehensive understanding of conceptual and design principles. The unit emphasizes applying this knowledge in designing embedded IoT systems across various real-world scenarios. The IoT-embedded simulation software tools, including Wokwi, Blynk, ThingSpeak, and ThingsBoard, will support the learning process. Lecture sessions form the foundation for grasping conceptual knowledge, with practical application during workshops that involve tasks such as intelligent sensor development, mobile programming, and IoT platforms.

While weekly lecture notes will be provided, students are encouraged to view them as a guide rather than a substitute for their own personal notes or the recommended reading list. Active engagement with the material is encouraged, supplementing understanding through provided lecture notes, personal notes, and suggested readings. This proactive approach is crucial for a robust comprehension of the syllabus topics and contributes to an enriched learning experience in real-time operating systems.

Assignments

Students will complete two major assignments, each designed to assess their ability to conceptualize, design, and implement embedded IoT hardware systems in various application contexts. To support a structured and in-depth approach, students are given four weeks to complete each assignment. Assignment 1, due by 11:55 PM on Sunday, 13th September (end of Week 7), contributes 40% to the overall course grade. This includes 20% for the design and implementation of a programming application, 10% for answering assignment-specific theoretical questions, 5% for the written project report, and 5% for the presentation and discussion, which evaluates students' ability to articulate and communicate their project work. Assignment 2, due by 11:55 PM on Sunday, 25th October (end of Week 11), contributes 40% to the total grade, consisting of 20% for the programming application, 10% for theoretical questions, 5% for the project report, and 5% for the presentation and discussion. This comprehensive assessment

structure is intended to develop both the technical and communication skills essential for success in embedded system design and IoT programming.

Workshop

The workshop sessions will be conducted onsite across 12 meetings, from Week 2 to Week 13. During Weeks 2 to 11, students will engage in practical modules designed to develop their skills in embedded IoT systems. Weeks 12 and 13 are allocated for make-up sessions, which are available only to students who were unable to attend earlier workshops, with a limit of two make-up classes per student. These sessions provide essential hands-on experience, and students are required to submit a report summarizing the lab work completed during each session. The workshop component contributes 20% to the overall course assessment.

Course Reading Material Information

Please be aware that there isn't a single textbook covering all the content for this unit. However, your lecturer will provide comprehensive reading materials and detailed notes corresponding to each week's lecture topics. These resources will be provided every week for your convenience. It's essential to note that purchasing these books is not obligatory; their inclusion is based on individual preferences and needs. Students are encouraged to evaluate their requirements and determine whether acquiring these supplementary resources aligns with their learning preferences and objectives.

1. Oner, Vedat Ozan, "Developing IoT Projects with ESP32 : Unlock the Full Potential of ESP32 in IoT Development to Create Production-Grade Smart Devices," 2nd ed. Birmingham : Packt Publishing, Limited 2023.
2. Zulfiqar, Asim, "Hands-On ESP32 with Arduino IDE : Unleash the Power of IoT with ESP32 and Build Exciting Projects with This Practical Guide," First edition. Birmingham, UK : Packt Publishing Ltd. 2024.

Methods of Communication

Our primary means of communication will be through your university email and announcements on iLearn. It is crucial to consistently check your university email for important updates and information related to the course. Additionally, significant announcements will be posted on iLearn, a centralized platform for accessing vital details about the course. Should you have any queries or require assistance from the teaching staff, including the unit convenor, you have two communication channels. Firstly, you can post your queries on the iLearn discussion board, providing an interactive space for instructors and peers to engage in discussions. Alternatively, you may send emails to the corresponding addresses of the teaching staff using your university email address for official communication. Through these communication methods, we aim to ensure effective and timely dissemination of information and provide the necessary support throughout the course.

Unit Schedule

Week	Topic	Outcome
1	Introduction to Embedded Systems and IoT	ULO1
2	Microcontroller Architecture and Programming Part I	ULO3, ULO4
3	Microcontroller Architecture and Programming Part II	ULO2, ULO3, ULO4
4	Embedded Systems Programming Part I	ULO1,ULO2
5	Embedded Systems Programming Part II	ULO1,ULO2
6	Sensors and Actuators for IoT Part I	ULO1,ULO2,UL03
7	Sensors and Actuators for IoT Part II	ULO1,ULO2,UL03
8	Embedded IoT Hardware Platforms	UL01,UL02
9	Advanced Topics in Embedded Systems Part I: Distributed Embedded Systems	UL01,UL02
10	Advanced Topics in Embedded Systems Part II: System-on-Chip (SoC)	UL04,UL05
11	Embedded System Design and Implementation Part I	UL01,UL05
12	Embedded System Design and Implementation Part II	UL01,UL05
13	Guest Lecture: Emerging Trends in Embedded Systems and IoT	UL03,UL05

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit connect.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Ask a Study Coach
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support

- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit https://students.mq.edu.au/support/technology/service-desk.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

We value student feedback to be able to continually improve the way we offer our units. As such we encourage students to provide constructive feedback via student surveys, to the teaching staff directly, or via the FSE Student Experience & Feedback link in the iLearn page.

Student feedback from the previous offering of this unit was very positive overall, with students pleased with the clarity around assessment requirements and the level of support from teaching staff. As such, no change to the delivery of the unit is planned, however we will continue to strive to improve the level of support and the level of student engagement.

Unit information based on version 2026.02 of the Handbook