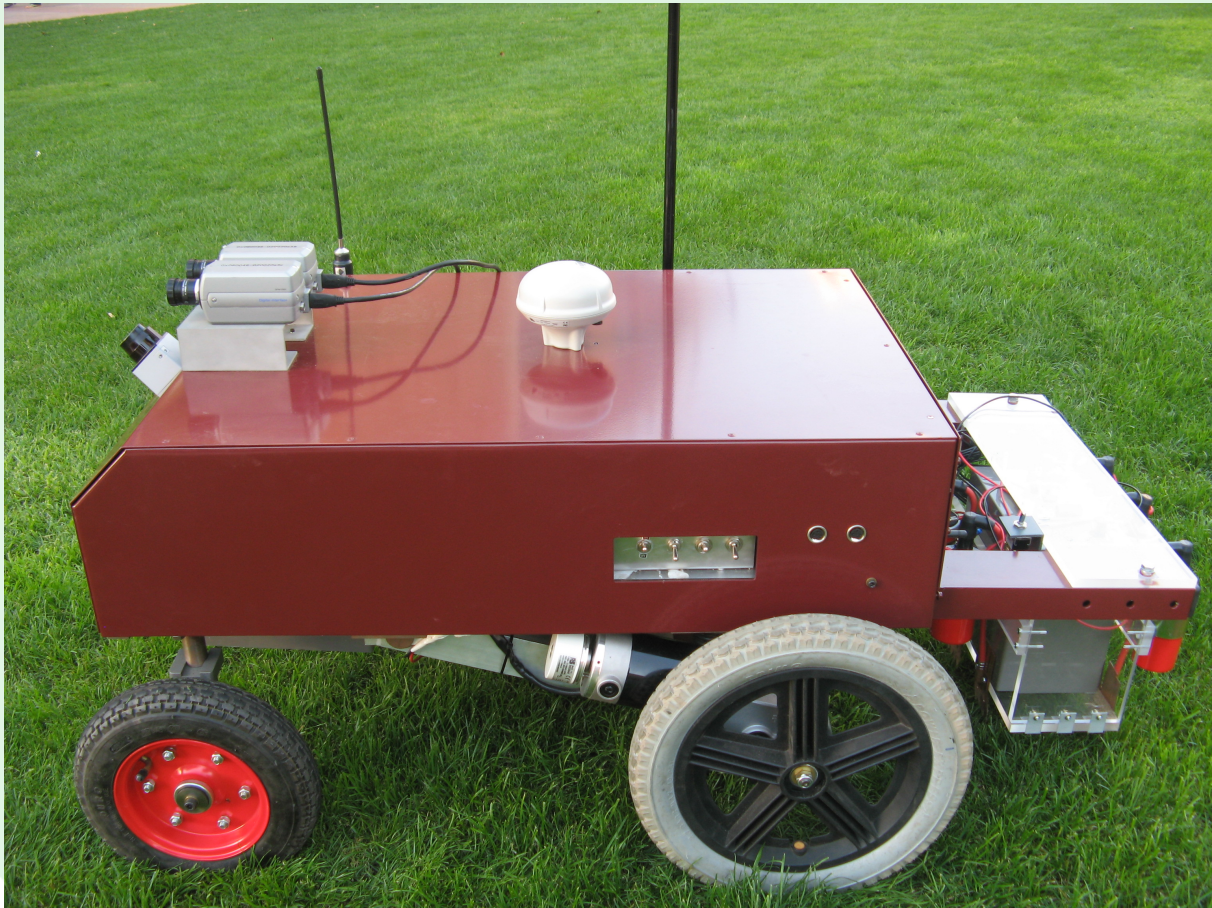# MTRN3500

Computing Applications in Mechatronics Systems

Term 3, 2021

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Jay Katupitiya	J.Katupitiya@unsw.edu.au	Arranged via email or teams messages	510E Ainsworth Building	9385 4096

Demonstrators

Name	Email	Availability	Location	Phone
James Stevens	James.Stevens@unsw.edu.au	Arranged through email contact	On line	Teams contact

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services
- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook

Course Details

Units of Credit 6

Summary of the Course

The aim of this course is to implement software for vehicle control. The previously acquired C/C++ programming knowledge is used to write software for interfacing of data acquisition systems, motion control systems, sensors such as inertial sensors, GPS sensors, laser sensors and encoders to facilitate sensing and actuation. The interfacing component will teach how to use an industrial grade PLC as the general interface device that allows data exchange between a control computer and a vehicle. The PLC will be used as the low level sensing and actuation element. The high level vehicle control software will directly interface with laser range finders, GPS systems and camearas to achieve perception for vehicle control. The course has an extensive experimental content where the above developed software will be used to control either a tracked vehicle or a wheeled vehicle.

Course Aims

The couse aims to develop the skills required to develop a fully functional autonomous system by understanding the hardware and software requirements and then developing a complete software package to interact with the hardware of an autonomous system. The software will be developed using C/C++ on a Windows PC platform.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Be well versed with structured and modular programming using C/C and to have appreciated the use of software to communicate with external devices.	PE1.3, PE1.4, PE1.5
2. Be able to understand data structures, data transfer and transmission as well as inter-process communication.	PE1.1, PE2.1, PE2.3
3. Be able to develop full software packages that are usable with commercial grade Mechatronic systems.	PE2.3, PE2.2

Teaching Strategies

This couse adapts a learning based approach. The students are required to watch the pre-recorded videos and do the minor quizzes. During the leactures the content in the pre-recorded videos will be complemented by more practical information. The couse is heavily hardware use based and the students are expected to interact with them and develop software to make the hardware operational.

Additional Course Information

This course heavily relies on your prior programming knowledge and C/C++ knowledge. The standard pre-requisite is MTRN2500.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Continuous assessment using quizzes.	60%	Immediately	1, 2, 3
2. Demonstration of sensor operation and vehicle movement conforming to inputs.	20%	29/10/2021 11:59 PM	1, 2, 3
3. Demonstration of the PLC interface software	20%	26/11/2021 11:59 PM	1, 2, 3

Assessment 1: Continuous assessment using quizzes.

Assessment length: Major Quiz 1 (35 mins), Major Quiz 2 (55 mins), Major Quiz 3 (45 mins) + 5 mins minor quizzes each week.
Submission notes: Refer to quiz announcements for exact dates and times.
Due date: Immediately
Deadline for absolute fail: Immediately after the quiz close times.
Marks returned: Immediately

The 60 marks will be broken down into Major Quiz Part 1 in Week 4 Friday (13 marks), Major Quiz Part 2 in Week 8 Friday(20 marks) and Major Quiz Part 3 in Week 10 Friday (17 marks) and 10 marks for minor quizzes in weeks 1-5 and 7-10. There will be no end of term examination.

Assessment criteria

Major Quiz Part 1 - 13 Marks

Major Quiz Part 2 - 20 Marks

Major Quiz Part 3 - 17 Marks

Minor Quizzes - 10 Marks

Assessment 2: Demonstration of sensor operation and vehicle movement conforming to inputs.

Submission notes: Electronic submission of zipped files.
Due date: 29/10/2021 11:59 PM
Deadline for absolute fail: 03/11/2021 11:59 PM
Marks returned: 12/11/2021 11:59 PM

As an individual project, each student must develop a complete software package to control the Unmanned Ground Vehicle (UGV) called Weeder.

This is not a Turnitin assignment

Assessment criteria

Please see the assignment specification for the detaild breakdown of marks assigned.

Additional details

This assignment has a progress check in week 4.

Assessment 3: Demonstration of the PLC interface software

Submission notes: submission of specified files.
Due date: 26/11/2021 11:59 PM
Deadline for absolute fail: 01/12/2021 11:59 PM
Marks returned: 10/12/2021 11:59 PM

The students must develop software to carry out data exchange between a Windows PC and an external device using a PLC.

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment criteria

Please refer to the assignment specification for the breakdown of marks allocated.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 13 September - 17 September	Lecture	C/C++ Refresher + Introduction to lab experiments
	Assessment	Week 1 Minor Quiz
Week 2: 20 September - 24 September	Lecture	Introduction to CLR based C++
	Assessment	Week 2 Minor Quiz
Week 3: 27 September - 1 October	Lecture	Shared Memory and Inter-process Communication
	Assessment	Week 3 Minor Quiz
Week 4: 4 October - 8 October	Lecture	Process Management
	Assessment	Week 4 Minor Quiz
	Assessment	Major Quiz Part 1
Week 5: 11 October - 15 October	Lecture	Ethernet Communication
	Assessment	Week 5 Minor quiz
Week 6: 18 October - 22 October	-- Select --	Flexibility week
Week 7: 25 October - 29 October	Lecture	Serial Communication
	Assessment	Week 7 Minor Quiz
	Assessment	Assessment and submission of Assignment 1
Week 8: 1 November - 5 November	Lecture	Interfacing: CPU, Peripherals and External Devices + Programming External Devices
	Assessment	Week 8 Minor Quiz
	Assessment	Major Quiz Part 2
Week 9: 8 November - 12 November	Lecture	Programming Data Acquisition Systems and Programming the PLC

	Assessment	Week 9 Minor quiz
Week 10: 15 November - 19 November	Lecture	Development of a Flight Controller: Software for complex systems. No lecture but the students are required to watch the pre-recorded video.
	Assessment	Week 10 Minor quiz
	Assessment	Major Quiz Part 3
Study Week: 20 November - 25 November	Assessment	Assessment and submission of Assignment 2

Resources

Prescribed Resources

Through Moodle the students will have access to pre-lecture video content, lecture slides, sample programs, and hardware documentation.

Recommended Resources

Online resources of C/C++ programming.

UNSW Library website: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/course/view.php?id=62141

Teams: https://teams.microsoft.com/l/team/19%3aVBecgVyjld88y0J4eD6RJ7dZIokOXESPzKpWSPEYP Sc1%40thread.tacv2/conversations?groupId=cd05e77c-af00-4bb7-914c-327d478a6972&tenantId=3ff6cfa4-e715-48db-b8e1-0867b9f9fba3

Course Evaluation and Development

Students requested longer access to the hardware. This time, the hardware is made avilable online and the students can access the hardware 24 hours a day 7 days a week if the hardware is not used by another student. The number of hardware units is increased from 6 to 24.

Laboratory Workshop Information

While every student should work with the hardware, they can only be accessed online. Even under normal circumstances the student are not expected to tangibly interact with this hardware. To facilitate visualization every student is provided with a camera image stream showing the activities taking place at the laboratory.

Submission of Assessment Tasks

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late policy

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) of the maximum mark possible for that assessment item, per calendar day, for a minimum of zero marks.

The late penalty is applied per calendar day (or part thereof), including weekends and public holidays, that the assessment is overdue.

Work submitted after the 'deadline for absolute fail' is not accepted and a mark of zero will be awarded for that assessment item. For example:

- Your course has an assessment task worth a total of **30 marks (Max Possible Mark)**
- You submit the assessment **2 days after the due date**
- The assessment is marked as usual and achieves a score of **20 marks (Awarded Mark)**
- The late policy is applied using **Late Mark = Awarded Mark - (Days*Penalty per Day)*Max Possible Mark**. Your adjusted final score is **8 marks** (20 - ((2*0.2)*30)).

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates. For further information on

exams, please see the [Exams](#) webpage.

Special Consideration

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

UNSW now has a [Fit to Sit / Submit rule](#), which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID-19 illness or isolation** will be required.

Special Consideration Outcomes

Assessments have default Special Consideration outcomes. The default outcome for the assessment will be advised when you apply for Special Consideration. Below is the list of possible outcomes:

Outcome	Explanation	Example
Time extension	Student provided more time to submit the assessment	e.g. 1 more week of time granted to submit a report
Supplementary assessment	Student provided an alternate assessment at a later date/time	e.g. a supplementary exam is scheduled during the supplementary exam period of the term
Substitute item	The mark for the missed assessment is substituted with the mark of another assessment	e.g. mark for Quiz 1 applied also applied as mark for Quiz 2, meaning if a student achieved a mark of 20/30 for Quiz 1 and was granted Special Consideration for Quiz 2, a mark of 20/30 would be applied for Quiz 2, etc
Exemption	All course marks are recalculated excluding this assessment and its weighting	e.g. The course has an assessment structure of: - Assignments 30%, - Lab report 30%, - Final Exam 40%. If the Lab report is missed and student is granted Special Consideration, then the assessment structure may be reweighted as follows: - Assignments 50% - Final Exam 50% as though the Lab report did not exist
Non-standard	Course Coordinator is contacted for the outcome when special consideration is granted as the outcome differs on a case-by-case basis	e.g. typical for group assessments where time extension supplementary assessment could be granted to the group member, time extension could be granted to the whole group, etc. Clarify with your Course Convenor for

Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW 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.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

On-campus class attendance

T3-2021 UPDATE
Classes will be entirely ONLINE until at least Week 6, after which we will receive further advice from UNSW about the return of face-to-face classes. Students who are enrolled in face-to-face classes will have access to the course's online content but NO classes will be changed to reflect online delivery until Week 6 due to uncertainty regarding delivery mode for the rest of the term. Please go to your course's Moodle modules and MS Teams sites for further information about accessing course resources and content.

- -

Public distancing conditions must be followed for all face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. No over-enrolment is allowed in face-to-face classes. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

Guidelines

All students are expected to read and be familiar with UNSW guidelines and polices. In particular,

students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)

Image Credit

This photograph was taken by Associate Professor Jay Katupitiya.

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	