



Title:	Mobile Robotics APPROVED
Long Title:	Mobile Robotics
Module Code:	INTR6020
Duration:	1 Semester
Credits:	5
NFQ Level:	Fundamental
Field of Study:	Interdisciplinary Engineering
Valid From:	Semester 1 - 2020/21 (September 2020)
Module Delivered in	3 programme(s)
Module Coordinator:	MARTIN HILL
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Module Description:	Mobile Robotics introduces the student to the fundamental concepts of autonomous mobile robot platforms. The goal of this course is to provide the student with an understanding of the principles that influence mobile robot design, the sensors and actuators that facilitate the robot's interaction with the 'real' world and software architectures used to control such systems.
Learning Outcomes	
<i>On successful completion of this module the learner will be able to:</i>	
LO1	Describe the operating principles of common sensors used in mobile robotics.
LO2	Process and interpret raw sensor output for navigation purposes.
LO3	Implement software to drive the actuator/effector elements of a typical mobile robot platform.
LO4	Discuss the attributes of software architectures suitable for autonomous mobile robot control.
LO5	Develop a sensor/software solution, using a dedicated robotic platform, for a basic autonomous robot problem.
LO6	Understand the ethical responsibilities that should be applied during robotic software development.
Pre-requisite learning	
Module Recommendations <i>This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named MTU module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).</i>	
Incompatible Modules <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Basic Programming Concepts:

Introduction to program flow, variables, conditional statements.

Advanced Programming Concepts:

Control structures, data collection, state machines, multitasking.

Sensors:

Operating principles of selected sensors such as those for position, speed, touch, sonar and light detection.

High-level Control Strategies:

Dead-reckoning approaches, reactive, deliberative, subsumption and behaviour-based architectures.

Path Planning Algorithms:

Depth-first, breath-first searches, overview of hill-climbing approaches.

Ethical Considerations in Robotics:

Presentation and discussion of material considering topics such as the application of precautionary principles, artificial system autonomy and accountability, responsibilities for (possibly unintended) warfare applications and the nature and impact of human-machine cognitive and effective bonds on individuals and society.

Assessment Breakdown

%

Course Work

100.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Short Answer Questions	Assessment of class material to date	1,2	15.0	Week 5
Practical/Skills Evaluation	Short exercises in processing sensor data and the control of drive actuator elements	1,3	30.0	Week 7
Short Answer Questions	Assessment of class material to date	4,6	15.0	Week 11
Project	Develop a solution for a specified mobile robotic problem. A report should be submitted detailing the architectural design decisions taken and any practical implementation issues that arose during the implementation of the final solution. The report should be 7-9 pages in length including diagrams, code, descriptions and references.	1,2,3,4,5,6	40.0	Week 13

No End of Module Formal Examination

Reassessment Requirement

Coursework Only

This module is reassessed solely on the basis of re-submitted coursework. There is no repeat written examination.

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lab	Laboratory-delivered theory	2.0	Every Week	2.00
Lab	Laboratory-delivered practice	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Study of class material and project analysis and design	3.0	Every Week	3.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				4.00

Workload: Part Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lab	Laboratory-delivered theory and practice	3.0	Every Week	3.00
Independent & Directed Learning (Non-contact)	Study of class material and project analysis and design	4.0	Every Week	4.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				3.00

Module Resources

Recommended Book Resources

- **Wei Lu 2016, *Beginning Robotics Programming in Java with LEGO Mindstorms*, Apress [ISBN: 1484220048]**
- **Maja J. Mataric 2007, *The Robotics Primer*, The MIT Press [ISBN: 978026263354]**

Supplementary Book Resources

- **Alexander Schaub 2017, *Robust Perception from Optical Sensors for Reactive Behaviors in Autonomous Robotic Vehicles*, Springer Vieweg [ISBN: 978-365819086]**

This module does not have any article/paper resources

This module does not have any other resources

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_ESMPR_8	<u>Bachelor of Engineering (Honours) in Smart Product Engineering</u>	3	Elective
CR_EELXE_7	<u>Bachelor of Engineering in Electronic Engineering</u>	3	Elective
CR_EELXE_6	<u>Higher Certificate in Engineering in Electronic Engineering</u>	3	Elective