SYST C3603: Robotic Operating Systems

Module Title:	Robotic Operating Systems
Language of Instruction:	English

Credits:	5

NFQ Level:	7

Module Delivered In	2 programme(s)

Teaching & Learning Strategies:	This module will be delivered through a mix of lectures, laboratory assignments, and projects including a professional write-up. It will employ a mixture of active/task-based learning, reflective learning, and problem-based learning.

Module Aim:	Robotic systems are implementing their control systems using the Robot Operating System (ROS) in both industry and academia. ROS supplies a development environment for modular control and communication infrastructure of robotic systems using an open-source library of control and data processing algorithms. In this course, we shall cover the development of software modules in ROS and integration into a completely functional system for autonomous robot control.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Use ROS communication tools to exchange information to create and visualise a custom robot environment.
LO2	Analyse and map an environment and navigate a mobile robot around that environment
LO3	Implement a pick-and-place function with industrial robot arms.
LO4	Design a complete robotic application with state machines within an individual or group project setting depending on the complexity.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
OS (Linux), Programming (variables, loops, functions, conditionals), linear algebra.

SYST C3603: Robotic Operating Systems

Module Content & Assessment

Indicative Content
Linux operating system refresher Linux install, ROS installation etc
Programming language refresher Python and C/C++
Introduction to the Robot Operating System Services, actions, nodes in ROS. Control systems in SCADA.
Unified Robot Description Format Use Unified Robot Description Format (URDF), ROS parameter server, and simulation of real-world object representations.
Robot vision Robot vision with object detection and pose estimation
State machines and file systems State machines design and behaviour and the ROS file system and SCADA logs.
Map creation and navigation Map creation and autonomous navigation of a known map e.g., GMapping
Motion Planning and Behaviour Motion planning and pick and place behaviours using industrial robots e.g., ROS MoveIt.
Safety and Cybersecurity Coding styles and standards for safety, security and key management, Penetration testing support.

Assessment Breakdown	%
Continuous Assessment	50.00%
Project	50.00%

Continuous Assessment				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	n/a	1,2,3,4	50.00	Every Week

Project				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	n/a	1,2,3,4	50.00	Sem 2 End

No Practical

No End of Module Formal Examination

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

SYST C3603: Robotic Operating Systems

Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	Every Week	2.00
Laboratory	Every Week	3.00
Independent Learning	Every Week	3.00
	Total Hours	8.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEROB_B	Bachelor of Engineering (Honours) in Robotics and Automated Systems	5	Mandatory
CW_EEROO_D	Bachelor of Engineering in Robotics and Automated Systems	5	Mandatory