

TRON H4617: Embedded Linux Development

Module Title:		Embedded Linux Development	
Language of Instruction:		English	
Credits:	5		
NFQ Level:	8		
Module Delivered In		No Programmes	
Teaching & Learning Strategies:		Teaching will be a blend of lectures, tutorials and practical classes.	
Module Aim:		To equip students with the knowledge and skills required to design, build, administer and evaluate a Linux based embedded system which is interfaced to the internet (IoT).	

Learning Outcomes			
On successful completion of this module the learner should be able to:			
LO1	Design and build a customised Linux image which is optimized for an embedded system.		
LO2	Design scripts to administer a Linux based embedded system.		
LO3	Configure a system by adding or removing device drivers (modules) from the Linux kernel.		
LO4	Install, configure and harden a webserver.		
LO5	Plan, design and implement a system that will interface sensor(s) to the cloud. (Internet of Things (IoT) based application).		
LO6	Evaluate the performance of an embedded system using specified metrics & constraints (power, speed/latency, etc.)		

Pre-requisite learning
<i>Module Recommendations</i> This is prior learning (or a practical skill) that is recommended before enrolment in this module.
No recommendations listed
<i>Incompatible Modules</i> 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.
No requirements listed



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Module Content & Assessment

Indicative Content			
(a) Linux architecture Linux architecture, embedded Linux, installing Linux & the bootloader.			
(b) Linux as an Embedded OS Advantages and limitations of Linux as an embedded operating system. Introduction to real time systems.			
(c) System Administration System administration, configuring a static IP address, superuser, adding users, Linux file system, file system commands.			
(d) Security considerations User and process permissions. System security.			
(e) Processes Foreground & background processes. I/O redirection, interprocess communication, pipes, sockets, filters, etc.			
(f) Utilities Shell commands and shell scripts.			
(g) Firmware development Programming in C using gcc, gdb, make file, etc. System call interface, introduction to writing device drivers. Loading, unloading, blocking & blacklisting device driver modules (Ismod, insmod, rmmod, etc)			
(h) Hardware interfacing Hardware interfacing - GPIO, Analog I/O, I2C, SPI, sensors, etc.			
(i) Networking Communications & Networking - SSL, SSH, Bluetooth, Ethernet & Wi-fi.			
(j) Webserver configuration Install, configure and harden a webserver (e.g. Apache).			
(k) System performance profiling Performance metrics & constraints (power, speed/latency, etc.)			
(k) Mini-projects Mini projects - which may include developing an Internet of Things (IoT) application, video streaming & audio streaming.			
Assessment Breakdown	%		

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Continuous Assessment	20.00%
Practical	40.00%
End of Module Formal Examination	40.00%

Continuous Assessment				
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Examination	Students will be assigned an number of assignments and/or class tests as part of the assessment of this module. Students may be asked to complete assignments during class or as homework.	1,2,3,5,6	20.00	Week 7

No Project

Practical				
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Students will complete a number of mini projects, each of which may be completed over several weeks in the laboratory.	1,2,3,4,5,6	40.00	n/a

End of Module Formal Examination				
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	A written examination, at the end of the module, will examine the extent of the student's achievement of the learning outcomes.	1,2,3,5,6	40.00	End-of- Semester

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



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Module Workload

Workload: Full Time			
Workload Type	Frequency	Average Weekly Learner Workload	
Lecture	Every Week	1.00	
Laboratory	Every Week	1.50	
Independent Learning	Every Week	1.00	
	Total Hours	3.50	