Embedded Systems Programming and Applications in the Environment

Module Information

2022.01, Approved

Summary Information

Module Code	5401ELE
Formal Module Title	Embedded Systems Programming and Applications in the Environment
Owning School	Engineering
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 5
Grading Schema	40

Teaching Responsibility

LJMU Schools involved in Delivery
Engineering

Learning Methods

Learning Method Type	Hours
Lecture	22
Practical	22

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-CTY	CTY	September	12 Weeks

Aims and Outcomes

Aims	The module aims to broaden the students' knowledge and understanding of digital circuit design, and examines modern microcontroller architectures and the interface requirements to external systems. It also aims to provide students with practical skills necessary to design, analyse and implement electronic circuits controlled by microcontrollers and finite state machines for real life applications in environment.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Define electronic circuit operations and design
MLO2	2	Design, analyse and implement finite state machine based digital circuits
MLO3	3	Describe and identify suitable interfaces for modern microcontroller/embedded systems
MLO4	4	Select appropriate hardware, software platforms and interface considering power, cost and capability requirements
MLO5	5	Produce integrated embedded systems with external sensors and actuators

Module Content

Outline Syllabus	Review of Boolean algebra and Karnaugh maps. Counter Design Synchronous sequential state machine design and analysis, including Mealy, Moore and mixed type circuits. Asynchronous sequential design. Identify the advantages and disadvantages of various processors available on the market. Research the costs of mass production identifying the power and capability of the devices. Plan for the power requirements of embedded systems, considering different use case requirements in real-life applications. Create embedded systems that interface with various sensors, both analogue and digital, ensuring that inputs are buffered to protect the processor from hazardous conditions. Integrate processors with control devices e.g. Arduinos, Servos, DC Motors, etc.
Module Overview	
Additional Information	This module introduces the students to digital electronics, embedded systems, microcontrollers for applications the Environment. General Notes UNESCO Sustainable Development GoalsQuality EducationGender EqualityAffordable and Clean EnergyIndustry, Innovation and InfrastructureSustainable Cities and CommunitiesResponsible Consumption and ProductionPeace, Justice and Strong InstitutionsPartnerships for the GoalsUK SPEC AHEP 4CEng. M3 Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.M4 Select and critically evaluate technical literature and other sources of information to solve complex problems.M5 Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standardsM6 Apply an integrated or systems approach to the solution of complex problems.M7 Evaluate the environmental and societal impact of solutions to complex problems (to include the entire lifecycle of a product or process) and minimise adverse impacts.M8 Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.M10 Adopt a holistic and proportionate approach to the mitigation of security risks.M11 Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.M12 Use practical laboratory and workshop skills to investigate complex problems.M13 Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.M14 Discuss the role of quality management systems and continuous improvement in the context of complex problems.M16 Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.IEng.B1 Apply knowledge of mathematics, statistics, natural science and engineeringprinciples to broadly-defined problems. Some of the knowledge will be informed by current developments in the subject of study.B2 Analyse broadly-defined problems reaching substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles.B3 Select and apply appropriate computational and analytical techniques to model broadly-defined problems, recognising the limitations of the techniques employed.B4 Select and evaluate technical literature and other sources of information to address broadly-defined problems.B5 Design solutions for broadly-defined problems that meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.B6 Apply an integrated or systems approach to the solution of broadly-defined problems.B7 Evaluate the environmental and societal impact of solutions to broadly-defined problems.B8 Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.B10 Adopt a holistic and proportionate approach to the mitigation of security risksB11 Recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.B12 Use practical laboratory and workshop skills to investigate broadly-defined problems.B13 Select and apply appropriate materials, equipment, engineering technologies and processes.B14 Recognise the need for quality management systems and continuous improvement in the context of broadly-defined problems.B16 Function effectively as an individual, and as a member or lead

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Centralised Exam	Exam	70	2	MLO1, MLO2, MLO3, MLO4, MLO5
Centralised Exam	Assignment	30	0	MLO1, MLO2, MLO3, MLO4

Module Contacts