WM915-15 Robust Automotive Embedded Systems

21/22

Department
WMG
Level
Taught Postgraduate Level
Module leader
Valentina Donzella
Credit value
15
Module duration
2 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Robust Automotive Embedded Systems aims to provide the students with a comprehensive knowledge of:

- embedded automotive systems from an hardware and software viewpoint;
- robustness of embedded system in the context of smart connected and autonomous vehicles.
  The module aims to systematically analyse industry motivations, legislations, roadmaps and customer requirements related to automotive embedded systems. Key parameters to design, test and evaluate robustness of the on-board electronics systems are discussed. Topics are introduced from a practical viewpoint thus allowing the students to critically and independently apply the learning to design, assess and test a wide variety of embedded systems used in smart connected and autonomous vehicles.

Module web page

Module aims

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knowledge of:

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- robustness of embedded system in the context of smart connected and autonomous vehicles. The module aims to systematically analyse industry motivations, legislations, roadmaps and customer requirements related to automotive embedded systems. Key parameters to design, test and evaluate robustness of the on-board electronics systems are discussed. Topics are introduced from a practical viewpoint thus allowing the students to critically and independently apply the learning to design, assess and test a wide variety of embedded systems used in smart connected and autonomous vehicles.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Definition, terminology and classifications of smart connected and autonomous vehicles (SCAVs). Current status of SCAV and challenges;
- Introduction to embedded systems;
- basic structure of a typical automotive embedded system (hardware/software);
- Overview of the different embedded systems in the context of automotive applications;
- A case study of an automotive electronic control unit.
- Overview of robustness, including covering aspects such as faults/failures, reliability/dependability and safety related automotive embedded systems;
- Main features and requirement for automotive electronics;
- Parasitic components in electronics circuits, environmental and operational conditions, aging;
- Analysis and simulation of parasitic components and their effect on circuit response;
- Automotive software development and documentation;
- Automotive software robustness including investigated coding best practices;
- Automotive standards and guidelines (MISRA C and ISO 26262);
- Introduction to version control;
- Models for developing complex embedded systems using V-model and Model Based Design (MBD).
- Understanding requirements capture, including natural, semi-formal, and formal requirements;
- General approaches to testing, functional/non-functional, randomised and generation of test cases.
- Design and development of ADAS electronics systems;

Learning outcomes

By the end of the module, students should be able to:

- Independently design and simulate one function of an advanced driving assistance/autonomous driving embedded system, evaluating its robustness from a software an hardware point of view
- Independently analyse and simulate an electronic circuit taking into account parasitic

components and dependencies on environmental and working parameters
- Critically evaluate the quality of a program used to drive an automotive embedded system and independently identify weaknesses
- Critically understand the implication of automotive guidelines (MISRA C, ISO 26262) on system design and robustness
- Critically interpret and criticise current automotive embedded systems development processes
- Independently generate test cases for functional and not functional testing of automotive embedded systems

Indicative reading list

For reference:

- “Automotive Embedded Systems Handbook” edited by N. Navet, F. Simonot-Lion, CRC Press, 2009, ISBN: 9780849380266.
- “Understanding Automotive Electronics; An Engineering Perspective”, William Ribbens, Butterworth Heinemann, 7th Edition, 2012, ISBN: 9780080970974.
- “Bosch Automotive Electrics and Automotive Electronics; Systems and Components, Networking and Hybrid Drive”, Bosch Professional Automotive Information, Robert Bosch GmbH, Springer, 5th Edition, ISBN 978-3-658-01784-2.
  A variety of up-to-date sources including:
- Latest government / UK Automotive Council roadmaps for autonomous vehicles
- Latest automotive legislation and standards
- Current academic research in the field of smart connected and autonomous vehicles.

View reading list on Talis Aspire

Subject specific skills

Automotive embedded system robustness, requirement, safety standards, V and V models, Model based development and related tools, software robustness, hardware robustness, testing.

Transferable skills

Team work; Work effectively in a group or team to achieve goals; Personal Motivation, Organisation and Time Management skills; Research and Analytical Skills; presentation skills; Oral and written communication skills

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Study

Study time

Type	Required
Lectures	19 sessions of 1 hour (13%)
Tutorials	5 sessions of 1 hour (3%)
Practical classes	5 sessions of 1 hour (3%)
Other activity	11 hours (7%)
Assessment	110 hours (73%)
Total	150 hours

Private study description

No private study requirements defined for this module.

Other activity description

Class presentations: 3 hr
Case studies/seminars: 3 hr
Syndicate exercises: 2 hr
Module review and PMA introduction: 1 hr
individual preparatory work: 2hr
Self-Directed Study: 110 hr

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A2

	Weighting	Study time
Post-module assessment	70%	110 hours
Problem set to be solved and justified		
In-module assessments	30%	

The IMA will be composed by a coursework comprising reports and answers to IMA questions and a 15-20 slide presentation based on the individual presentation during group work. Preparation and completion time is covered in learning hours breakdown.

Assessment group R1

	Weighting	Study time
Assessed work as specified by department 100% Assignment	100%	

Feedback on assessment

PMA and IMA. Scaled ratings for Comprehension, Effort and Presentation. Individual written feedback and overall mark.
Formative assessment during the group activities, tutorials, class quizzes using on-line tools (e.g. kahoot quizzes).

Availability

Courses

This module is Core optional for:

- Year 1 of TWMS-H33L Postgraduate Award Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33M Postgraduate Certificate Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33N Postgraduate Diploma Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33P Postgraduate Taught Smart, Connected and Autonomous Vehicles