WM9QC-15 Artificial Intelligence for Industry

25/26

Department
WMG
Level
Taught Postgraduate Level
Module leader
Leonardo Alves Dias
Credit value
15
Module duration
4 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The Artificial Intelligence for Industry module covers the essential principles and practical applications of robotics and automation, tailored specifically for industrial contexts. Participants will gain a comprehensive understanding of designing robotic systems, implementing control mechanisms, and leveraging automation technologies to optimise operational efficiency. The module content includes a blend of theoretical knowledge and hands-on experiences, focusing on how these technologies can be applied to enhance productivity and innovation in sectors like manufacturing, healthcare, and logistics. Through this module, learners will explore the integration of Artificial intelligence with robotics and automation, preparing them for the evolving demands of the industrial landscape.

Module aims

The AI for Industry module aims are equipping students with an in-depth understanding of the principles and practical applications of artificial intelligence in robotics and automation, specifically tailored for industrial applications.

The course objectives include:

- Introducing the core concepts of artificial intelligence as they relate to robotics, including design methodologies, control mechanisms, sensor fusion, and machine learning integration.
- In-depth understanding of the advancements and applications of automation technologies with a strong emphasis on their deployment in various industrial environments.
- Providing insights into the challenges, strategies, and innovative solutions involved developing AI-driven robotic systems for industrial use.
- Stimulating critical analysis and discussion about the transformative impact of AI, robotics and automation on industries, workforce dynamics, and society at large.
- Offering hands-on experience and practical skills in designing, implementing, and assessing AI-powered robots and automation systems to solve real-world industrial problems.

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.

1. Introduction to AI-Driven Robotics:
   Overview of the history and evolution of robotics, with a focus on the integration of AI.
   Fundamental components of AI-enhanced robotic systems, including sensors, actuators, and AI controllers.

2. AI in Robot Kinematics and Dynamics:
   Understanding the principles of AI-enhanced robot motion for improved precision and adaptability.
   Exploration of forward and inverse kinematics in AI contexts.
   Introduction to dynamics and AI-based control of robotic systems for enhanced efficiency and responsiveness.

3. Advanced Robot Control Systems:
   Examination of sophisticated control mechanisms, including PID, adaptive, and intelligent AI-driven controllers.
   Overview of control architectures tailored for AI applications, such as deliberative, reactive, and hybrid models.

4. Sensors, Signal Processing, and AI:
   Comprehensive review of sensor technologies enhanced by AI for superior data acquisition and analysis.
   Signal processing and sensor fusion techniques powered by AI for heightened sensory perception and decision-making accuracy.

5. AI and Automation Technologies:
   Fundamental principles of automation and its transformation through AI.
   In-depth analysis of AI-driven automation in key sectors: manufacturing, healthcare, and logistics.
   Strategies for integrating AI automation systems with existing business processes for operational excellence.

6. AI-Enhanced Robotics in Industry:

Detailed case studies illustrating the application and impact of AI-enhanced robotics across various industries.
Discussion on the challenges and emerging trends in the adoption of AI and robotics in industrial environments.

7. Ethical, Legal, and Societal Implications of AI in Robotics:
   Critical examination of the ethical and legal considerations in deploying AI-driven robotics.
   Analysis of the impact of AI and automation on the workforce, societal structures, and ethical practices in technology use.

Learning outcomes

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

- Design and implement the fundamental control mechanisms and automation technologies in the creation of basic robotics systems.
- Assess the application, efficiency, and impact of robotics and automation technologies in various industries such as manufacturing, healthcare, and logistics.
- Apply theoretical knowledge and practical skills to design and solve real-world automation problems, demonstrating innovation and technical proficiency.
- Engage in collaborative projects to design, develop, and troubleshoot robotics and automation systems, enhancing teamwork, communication, and project management skills.
- Analyze and integrate ethical, legal, and societal considerations in the design and deployment of robotics and automation solutions, promoting responsible and sustainable technological development.

Indicative reading list

Siciliano, B. 2009, Robotics: modelling, planning and control, Springer, London.

Springer handbook of robotics, 2016, 2nd edn, Springer, Berlin.

Thrun, S., Burgard, W. & Fox, D. 2006, Probabilistic robotics, The MIT Press, Cambridge, Massachusetts;London, England;.

International

Topics are of high international demand

Subject specific skills

Robotics System Design
Control Systems Implementation
Robot Kinematics and Dynamics
Automation Process Integration
Sensors and Signal Processing
Ethical and Societal Impact Analysis

Transferable skills

Problem-Solving and Critical Thinking
Teamwork and Collaboration
Project Management
Communication Skills

Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Practical classes	20 sessions of 1 hour (13%)
Online learning (independent)	60 sessions of 1 hour (40%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

No private study requirements defined for this module.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

Assessment component	Weighting	Study time	Eligible for self-certification
Group Assessment	30%	18 hours	No

This assessment is a group project where students will work in teams to design and implement a

	Weighting	Study time	Eligible for self-certification

basic robotic system.

Peer Marking Process will be adopted in this assessment.

Reassessment component

Individual Presentation with Group Reflection			No

The individual presentation will be on the design and implement a basic robotic system with a personal reflection of group work.

Assessment component

Assignment	70%	42 hours	Yes (extension)

The essay should discuss the use of robotics and automation in a specific industrial sector, and current applications, potential future developments, and consider ethical and societal implications.

Reassessment component is the same

Feedback on assessment

Verbal feedback for group assessment. Written feedback for assignment.

Availability

There is currently no information about the courses for which this module is core or optional.