The Institution of Engineering and Technology

Academy

CPD

3.5 hours

An Introduction to the Connected and Autonomous Vehicles Landscape

This course is composed of 3 units plus a short final assessment. The first unit will give an overview of Connected and Autonomous Vehicles (CAVs) including both road-based CAVs, such as cars, buses, pods, etc., and non-road-based CAVs such as railways and aircrafts. Numerous CAV examples are given to illustrate CAV operation in different scenarios operating at different levels of autonomy. The unit also includes a history of the development of road-based CAVs.

The second unit gives an overview of the implications for the deployment of CAVs (for both road-based CAVs and non-road-based CAVs), including the potential benefits and drawbacks. It also looks at some of the potential barriers to large-scale CAV deployment and implications for cybersecurity.

The third unit is concerned with the future of CAVs, including how the vehicle manufacturing industry is changing and scenarios for CAV uptake over the coming decades. It also looks at CAV infrastructure requirements, potential use cases for road-based CAVs and the potential interaction between CAVs and traffic signal controllers.

Key features

- Provides an accessible but informative introduction to CAVs
- Thought-provoking and teaches students to think for themselves in what is a relatively new area.

Course units

- Connected Autonomous Vehicles – Overview
- Implications of Connected Autonomous Vehicles
- Future of Connected Autonomous Vehicles
- Final Assessment

What you'll learn

- Understand what CAVs are and how they are being used and developed across a range of sectors
- Understand the SAE classification for levels of autonomy
- Understand the historical background to the development of CAVs
- Understand the potential benefits, potential drawbacks, potential barriers and implications for cybersecurity associated with CAV deployment
- Understand the manufacturing trends within the motor vehicle industry and some of the potential scenarios for CAV uptake
- Understand how the existing road infrastructure might be adapted for CAVs
- Understand some of the potential use cases for CAVs

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Connected and Autonomous Vehicles Cyber Security

As new and emerging technologies alter the transport industry, there has been a rise in the demand for Connected and Autonomous Vehicles. This has placed cyber security at the top of the agenda. It is essential to understand the challenges involved as the world becomes more connected.

This course provides a broad introduction to cyber security issues for Connected and Autonomous Vehicles (CAVs). The course highlights the cyber security challenges and opportunities from a technical, people, process, regulatory and governance perspective.

Who should take this course

This course will benefit managers, professionals and non-information technology engineers within the automotive industry who want to gain a better understanding of cybersecurity for their role. It will also help senior management and those at the executive level who would like to understand the basic concepts, security strategy, governance and compliance. Students entering the automotive cyber industry can also benefit from this course.

Course pre-requisites

Knowledge of Connected and Autonomous Vehicles and ITS would be advantageous for learners.

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Course units

- Introduction to Cybersecurity
- Introduction to Cybersecurity for Connected and Autonomous Vehicles
- Cybersecurity in Connected and Autonomous Vehicles
- Internet of Things (IoT) Security
- Security in Mobile/Vehicle Communication
- Connected and Autonomous Vehicles Cyber Legal and Policy Frameworks
- Building Cyber Defences
- On-going Cyber Challenges for Connected and Autonomous Vehicles
- Final Assessment

What you'll learn

- Understand the cyber challenges for the Connected and Autonomous Vehicles and ITS industries, in particular the realisation that cyber security is a safety issue.
- Understand the vulnerabilities and threats for Connected and Autonomous Vehicles and ITS, including the supply chain.
- Identify and interpret the legal and regulatory frameworks applicable to CAV cyber.
- Know how to start developing / reviewing a cyber security strategy, including governance model.
- Understand the areas of cyber security that the Connected and Autonomous Vehicle industry needs to continue to develop if they are to meet expectations of public safety and build public confidence.

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Connected and Autonomous Vehicles Computer Vision and AI

This course covers the key topics in Computer Vision, Machine Learning, Deep Learning and Artificial Intelligence.

It provides a general overview of the key challenges faced when applying such techniques to Connected Autonomous Vehicles, starting with the fundamental concepts and techniques. Topics include:

- Connected Autonomous Vehicle Routing
- Game Theory
- Coordination

The course also shows how a variety of AI techniques can be combined to solve specific use-cases of Connected and Autonomous Vehicles.

Who should take this course

This course will be advantageous to junior and senior engineering learners whose primary role falls within the following industries: Civil, Transportation, Computing, Electronic. Mid-level to Senior Management can also take advantage of this course and gain a better understanding.

Course pre-requisites

Learners embarking on this course would benefit from having a basic understanding of engineering mathematics and a basic understanding of computers and algorithms.

Course units

- Overview of the Challenges
- Machine Vision
- Deep Learning
- Deep Learning for Machine Vision
- Reinforcement Learning
- CAV-Routing
- CAV-Coordination
- Game Theory and Mechanism Design
- Final Assessment

What you'll learn

- Discuss the key challenges and benefits of applying AI, Machine Learning and Computer Vision in CAV applications
- Select and apply a variety of AI, Machine Learning and Computer Vision techniques to CAV applications
- Model CAV coordination and routing problems
- Identify ethical and social impacts of CAVs

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Connected and Autonomous Vehicles Sensors and Sensor Fusion

This course will use real world case studies to cover the operational principles of the state-of-the-art sensors which are used in Connected and Autonomous Vehicles.

It will also explore key topics such as estimation and tracking, sensor fusion architectures and the principal algorithms used for sensor fusion, such as the Kalman Filter, the Extended Kalman Filter and the Unscented Kalman Filter.

Key features

- A broad overview of sensor fusion and filtering
- Insights into the types of sensors used in the autonomous industry
- This course offers a solid basis to someone that is starting on the topic and offers insights into more advanced topics, stimulating further learning activities

Who should take this course

The programme is aimed towards graduates and professional engineers wanting to acquire state-of the art knowledge on CAV technologies. Specifically, this course is aimed at Senior Engineers who are non-specialists of the subject, Project Managers or Junior Engineers.

Pre-requisites

- Basic statistical knowledge (Bachelor level)
- Basic understanding of signal processing (Bachelor level)
- A generical tech-savy audience should be able to follow first 6 units easily
- The last 2 units require more advanced statistical knowledge

Course units

- Random Processes and Estimation
- Sensors 1
- Sensors 2
- Sensors 3
- Multi-Sensor Fusion and Architectures
- Kalman Filter
- Kalman Filter and Extended Kalman Filter
- Unscented Kalman Filter
- Final Assessment

What you'll learn

- Understand and classify the types of sensors used in autonomous cars
- Understand the main types of sensor fusion architectures
- Understand real problems and be able to apply filter algorithms for linear and non-linear systems
- Learn about the operational principles of the state-of-the-art sensors used in Connected and Autonomous Vehicles
- Understand how Connected and Autonomous vehicles deal with estimation and tracking

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Connected and Autonomous Vehicles Connectivity

This course will provide an in-depth explanation into the concepts behind the connectivity of Connected and Autonomous Vehicles (CAVs). Learners will gain a better understanding on the general networking basic concepts as well the principles of wireless communication.

The course will look at key topics areas such as car-to-car and car-to-infrastructure and help to enhance your expertise and technical knowledge.

Using real-world case studies, the course will go into detail about the different approaches to connectivity used by both the US and EU during the development process and will look at the achievements of both regions.

Learners will also find an in-depth overview on wireless technologies such as Wi-Fi, GSM, 3G, 4G, 5G, SMS and the impact they are having on the industry and the influences that companies such as Google and Apple are having on the in-car connectivity of Connected and Autonomous Vehicles.

Pre-requisites

Learners should understand the basic general networking concepts – ISO 7-layer architecture, IP addressing and basic routing protocols knowledge.

Course units

- Connectivity – basic networking concepts for Connected and Autonomous Vehicles (CAVs)
- Vehicle telematics
- Introduction to ad-hoc networks – principles, problems, MANET, VANET
- Advanced – working within MANETs, VANETs for future ITS
- Introduction to (CAV) connectivity technologies – Wi-Fi, GSM, 3G, 4G, 5G, SMS
- Designing V2V and V2I applications – reference implementations and connectivity considerations
- Development of in-car apps
- Connected cars and the future of traffic control systems
- Final assessment

What you'll learn

- Understand the principles of modern networking systems and create novel (wireless) networking architectures for connected vehicles and infrastructures
- Understand the principles of modern wireless technologies - WiFi, GSM, 3G, 4G, 5G, SMS – and build applications using them
- Understand the principles of building modern ITS using wireless technologies and use these wireless technologies for designing wireless connectivity paradigms for CAVs

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Connected and Autonomous Vehicles

Human Factors and Human-Machine Interface (HMI)

This course introduces learners to the key topics, disciplines and science used by Human Factors (HF) Specialists and focuses on how these can be applied to the development of Connected and Autonomous Vehicles (CAVs).

Enhance your understanding on the Human Factors domain and learn to identify if and when it is appropriate to bring in the correct expertise to support the engineering process.

The course will also help learners to understand the different tools and methods that can be used and applied during the development process of Connected and Autonomous Vehicles features, products or services.

Who should take this course

This course is for anyone at any level interested in how the human integrates as part of the Connected and Autonomous System. The course will also be of interest for those that are keen to understand more about human capabilities and challenges in the development of Connected Autonomous Vehicle and user interfaces.

About our content partner

Our content partner Connected Places Catapult is the UK's technology and innovation centre for Intelligent Mobility. Enhancing and driving learner's expertise in Transport innovation.

Course units

- Introduction & Overview of Human Factors (HF)
- Usability and User Experience (UX)
- Research Methods
- Design & Evaluation Methods
- Trust & Acceptance
- Workload, Distraction and Human Error
- Anthropometry
- Sensory Capabilities
- Final Assessment

What you'll learn

- Achieve a baseline understanding of the core disciples and subject areas of Human Factors.
- Understand the inter-relationships between the sub-disciplines within Human Factors.
- Understand how Human Factors can influence design choices.
- Understand the methodologies that should be used to deliver human-centred CAV products and services.

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What makes the IET Academy different?

An in-depth online training resource, the IET Academy provides flexible e-learning using the latest, proven techniques to enhance engagement and recall. Our courses also provide:

- fully interactive units, with tasks to complete along the way
- flexible access, 'anytime, anywhere' to suit you
- training at your own pace, not that of a classroom tutor
- content that can easily be integrated into an existing teaching programme.

Courses are hosted on the renowned Cross Knowledge platform, which is simple and intuitive for anyone to use, regardless of their technical expertise. Working with high quality content partners who are experts in their areas, our courses are also written specifically for engineers.

Your cost-effective and flexible training solution

Engineers often need to keep up with fast-paced changes within their industry. E-learning through the IET Academy offers a cost-effective alternative to the challenge of finding and budgeting external training to keep up to date.

Benefits for your organisation

This course can be booked for multiple employees, ensuring that your workforce is up to date and working to the same level. The flexible access allows learners to complete modules in their own time and at their own pace, so that your business is not impacted by external training days.

Related courses

- Introduction to Railway Safety
- Electric Vehicle Charging Equipment Installation to BS7671: 2018 AMD 1
- Securing the Internet of Things Networks
- Introduction to 5G Network Engineering

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CPD

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