The road to driverless cars...
how can we make them work for everyone?
Connected and autonomous vehicles

Driverless cars are moving out of the realm of science fiction and into reality. There is already a staggering level of connectivity and autonomy in vehicles compared to just a decade ago. But what do we mean by ‘connected’ and ‘autonomous’? Could driverless cars really be available to everyone?

A fully autonomous car would be capable of carrying out all the operational functions of a traditional car, without a human operator. A truly connected car would connect to devices within the car as well as external networks such as the internet. This could provide system diagnostics to your garage, direct you to the nearest available parking, or instigate an immediate roadside assistance response.

Benefits and opportunities

- Improvements in road safety, with the potential for crash elimination. It’s predicted that over 2,500 lives could be saved by 2030, with 25,000 serious accidents avoided
- Greater energy efficiency and reduced carbon emissions as a result of automated driving rather than variable human driver behaviour
- Increased time for work or leisure. The average driver spends 235 hours in the car each year. Imagine if they could use that time more productively
- Independence for those unwilling, or unable to drive; for example those with disabilities, or those currently priced out of the market by high insurance costs
- New opportunities for OEMs, suppliers, and small businesses afforded by the new technologies. A survey by the SMMT has predicted the creation of 320,000 new jobs in the UK as a result of these developments

Challenges to implementation

The move towards autonomous vehicles is happening in recognised stages, starting with driver assistance. Currently only Level 2 (partial automation) is fully available to the public, requiring an active driver to be monitoring at all times.

Before we can realise full vehicle automation and connectivity, a number of challenges must be overcome:

- **Technology**
  It needs to be both dependable and secure, but also affordable.

- **Understanding customer usage**
  In order to develop the right technology, we need to understand how the customer will use it, including their behaviours and preferences.

- **Legal and ethical frameworks**
  In the event of an accident, who is liable? Is it the driver, manufacturer, or software creator? The law requires that a human be in control of his/her vehicle at all times. How will this need to change before autonomous vehicles can be accepted?

- **Public trust**
  Ultimately, full vehicle automation will be achieved, but will not be accepted if the public fail to trust it.

Levels of vehicle automation

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<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td><strong>No automation</strong>&lt;br&gt;The driver completely controls the vehicle at all times</td>
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<tr>
<td>1</td>
<td><strong>Driver assistance</strong>&lt;br&gt;(e.g. ABS, lane keep assist, cruise control)&lt;br&gt;Individual vehicle controls are automated, either lateral (steering) or longitudinal (breaking/acceleration) control of vehicle</td>
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<td>2</td>
<td><strong>Partial automation</strong>&lt;br&gt;(e.g. super cruise park assist)&lt;br&gt;At least two controls can be automated in unison (lateral and longitudinal control), but driver permanently monitors road</td>
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<td>3</td>
<td><strong>High automation</strong>&lt;br&gt;(e.g. highway pilot, self-parking)&lt;br&gt;The driver can fully control all safety-critical functions in critical conditions, but must take over control if requested</td>
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<td>4</td>
<td><strong>Full automation</strong>&lt;br&gt;(e.g. fully automated, self-driving vehicle)&lt;br&gt;The vehicle performs all safety-critical functions, with the driver not expected to control the vehicle at any time</td>
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How are we addressing this challenge?

New facilities

3xD Simulated Driving Environment
A first of its kind drive in, driver-in-the-loop, multi-axis driving simulator. Any car can be driven in, linked up, and driven through the simulated environment. It is a multi-sensory environment, enhanced with high definition 360 degree visualisation, 3D surround sound, and 3 camera eye tracking. A drive on motion base provides feedback, control systems trick the car into thinking that it’s running, and infotainment hardware in loop emulates external signal environments such as GPS, ITS, 3G/4G.

To increase realism for the driver, a 30 mile LiDAR scanned and photo realistic route of the Coventry area has been created.

Multidisciplinary research

Through our capabilities in automation systems, experiential engineering, cyber security, energy and electrical systems, visualisation, and business transformation, our multidisciplinary research includes:

- **Human interaction**: Human Machine Interfaces, Driver in Loop, driver acceptance and trust.
- ** Dependability**: addressing security, robustness and reliability, and validation and verification of complex electrical systems and software
- **Data analysis**: including energy efficiency and data fusion
- **Direct and indirect sensing**: driver state and health monitoring, the self-learning car
- **New business**: the potential of the Internet of Things

“Our focus is on making the new technology work on real cars, with real people, in real time”

Professor Paul Jennings, Professor of Experiential Engineering and Head of Energy and Electrical Systems
We carry out applied research on real world challenges and look ahead to what is possible. Working with partners, we apply our expert knowledge to help develop products that will have real impact on society and the economy.

Through our pioneering facilities and technologies we work with partners and manufacturers to develop new processes and systems. The 3xD Simulator and National Automotive Innovation Centre are exciting examples of how we transfer our expertise.

Groundbreaking research along the pathway to autonomy is currently being undertaken as part of the WMG/Jaguar Land Rover ‘Research for Advanced Concept Development’ (RACeD) Engineering Doctorate Programme.

Technical implementation and user focused research challenges linked to JLR’s mega projects are being addressed in the following areas:

- The self-learning car
- Next generation human machine interfaces
- The connected car
- On and off-board data platforms

All these projects utilise the 3xD Simulator and feed directly into JLR’s product development process.

We also transfer practical skills and latest thinking to engineering, business, and cyber security students, as well as automotive industry professionals. From one-day workshops right up to doctoral degrees, our education programmes cater for every level in a practical and engaging way.

How are we transferring this knowledge to industry?

Getting in touch

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