Fact Sheet

Connected & Autonomous Vehicles

Enabled by satellites to change the way we live and work
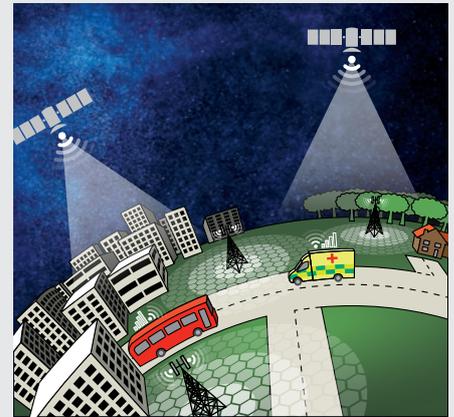
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The overall benefits of connected and autonomous vehicles are predicted to be £51 billion per year by 2030 and an extra 32,000 jobs.

Autonomous transport will rely on communications everywhere, with other vehicles, transport infrastructure and control rooms.

Overview

Connected and autonomous vehicles will change the way in which many of us commute. They offer the promise of saving time and money, getting people and goods to their destinations faster and more easily, and aiding mobility for disabled and older people. They have the potential to reduce collisions, and could save over 2,500 lives and prevent more than 25,000 serious accidents a year. It is also predicted that eventually we will no longer need driving licences or insurance, or even own our own cars – we will just book one via an app!

Reducing collisions and saving lives

The overall economic and social benefits of connected and autonomous vehicles are predicted to be in the region of £51 billion per year by 2030 and an additional 320,000 jobs in the sector for the UK.[1] Driverless cars won't appear overnight, however – by 2030 all cars will feature connectivity in some form, but only around 25% of vehicles are likely to be highly or fully automated.[1]

Satellites play an important role in the connectivity and autonomy of driverless cars, and the Satellite Applications Catapult is involved in initiatives to ensure that developments offer the best solution for both users and UK companies.

The Challenge

Driverless cars have captured recent headlines, offering the promise of more free time, lower insurance premiums and reduced congestion due to smoother traffic flow. Other vehicles, such as lorries, will also be driverless in future. In all cases, autonomous transport will rely on communications everywhere. They will need to communicate with other vehicles, transport infrastructures and back office control rooms in order to know accurately and reliably where they are, where they've been and where they are going in order to be able to predict both their route and that of other vehicles they may interact with.

Autonomous cars send and receive positioning data using reliable communications and sensors

Vehicle autonomy and connectivity is a wider topic than this, however. Even vehicles that have drivers still need reliable communications to communicate vital sensor and/or positioning information and to send or receive traffic- or location-based service data – this is not only to allow people get from A to B, but also to enrich that journey. Similarly, access to accurate timing will be vital for a range of functions, including autonomy.

When fully connected, sensors on vehicles can be used for wide variety of purposes, such as alerting emergency services if a vehicle crashes. They offer potential to businesses for tracking goods and vehicles, and can give advance warning of likely events, such as tyre failure, although functions like this will be more valuable when they interact seamlessly with support services.

A key challenge is therefore how to produce a totally reliable communication system for any vehicle at an affordable price. Every system – whether offering positioning or communications – needs to work anywhere, from built-up urban environments to remote country locations; they need to work in moving vehicles; and they need to be trustworthy, secure against hacking and jammers and resilient to environmental issues such as flooding. They also have to be intelligent enough to balance communication costs against signal quality, in order to make sure all data is reliably transmitted.

Satellites are more robust and more secure than mobile networks, and therefore ideal for broadcast information.

We are contributing our experience and knowledge of satellites to several projects, initially focussing on specialist markets.

How Satellites Can Help

Global navigation satellite systems (GNSS) provide accurate timing and positioning data. The best known is the Global Positioning System (GPS) and there are other global satellite positioning networks available. The European Union will shortly be launching its own system, Galileo, which should be operational by 2017. Once launched, Galileo with GPS will offer enhanced positioning data and more accurate information.

Historically, communications systems commonly relied on the networks used by mobile phones, such as 3G and 4G, although mobile phone networks tend to have poor coverage outside towns and cities – both in terms of availability and bandwidth.

Satellites providing navigation and communication data.

Satellites are more robust and inherently more secure than mobile networks as they have far fewer 'points of failure'. They are therefore ideal for broadcast information, where trustworthiness is vital – this could include road traffic warning systems. Using multiple communication frequencies further enhances robustness. This makes satellites ideal for services away from built-up areas as communication relies on clear line-of-sight from the transceiver.

High-rise buildings in towns can block some satellite signals; which is why seamless connectivity – such as that needed for vehicles – will rely in future on intelligent hybrid devices that can use multiple communication services, including Wi-Fi, 3G, 4G and the forthcoming 5G mobile networks, and satellite communications, connecting to the cheaper option at any time and sending only necessary information.

Catapult Involvement

In order for all vehicles to be connected by 2030, in-vehicle, seamless hybrid communications systems need to be available at affordable price points. The Catapult is contributing our experience and knowledge of satellites to several projects that are initially focussing on specialist markets – including a major European emergency services project called I_HeERO (see Case Study) – and will later move on to mass market solutions.

We are leading a consortium to create a UK GNSS Innovation Demonstration and Test Centre in Harwell, a project in collaboration with Ordnance Survey, Spirent Communications and the University of Nottingham. This facility will focus on positioning, navigation and timing (PNT) applications and services, and help us engage with end-users, including the automotive sector, enabling proof of concept, testing of prototype solutions and demonstrations of new capabilities.

Test drive of autonomous vehicle

With partners including Ordnance Survey and the Transport Research Laboratory, we are part of the Atlas initiative, funded by Innovate UK, which will examine the data needed for efficient autonomous navigation and how to maintain, process and distribute the data. This will include consideration of how satellite positioning can work in urban areas with other data, such as 'visual' recognition of landmarks and data from local sensors.

Another example is the 'Pathway to Autonomous Commercial Vehicles' (PACV) – a venture led by TruckTyre with Portsmouth University – which is one of the eight projects to be granted £20 million Government funding in February 2016 to develop the next generation of autonomous vehicles. Through PACV we are developing an innovative solution to monitor

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key information about tyre and brake performance, and predict safety risks which will be communicated to the driver, where there is one, and via a hybrid communications system to a remote operator.

The Future

Intelligent transport systems, including connected and autonomous vehicles, will be vital for meeting a number of the United Nations' 2030 Global Goals[2], including:

- Good Health and Wellbeing – includes the target of halving the number of global deaths and injuries from road traffic accidents by 2020.

- Sustainable Cities and Communities – includes the target of providing access by 2030 to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

These underscore our continued collaboration with UK and European partners and organisations to develop necessary technologies and applications.

Although there are many projects already underway, there is still plenty of opportunity for businesses of all sizes to get involved. We will bid for relevant intelligent transport system projects and are keen to hear from organisations who would welcome our expertise in satellite applications in this sector. There will also be many opportunities for application developers.

We will also be engaging with regulatory and standardisation processes to ensure the benefits of satellites can be fully exploited and that industry can respond with appropriate technology.

Case Study

I_HeERO – Infrastructure Harmonised eCall European Pilot

The Catapult is part of a consortium working on I_HeERO, the latest in a series of EU-funded projects that aim to prepare emergency services in Europe for full implementation of eCall

eCall enables emergency services alerts

(emergency call for cars) and shape the next generation NG112 eCall system. The Catapult's contribution to the eCall project includes providing low cost satellite communications to run simultaneously with eCall's current 2G communication system, which historically loses communications outside main cities and urban areas. The enhanced communications offered by satcomms will initially be used with coaches, lorries and motorcycles.

eCall enables an emergency call to be triggered either manually by the occupants of a vehicle or automatically by in-vehicle sensors. It establishes a voice connection with the relevant emergency call centre and sends a minimum set of data, of which the accurate location of the crash scene is most important as it enables rescue services to arrive as quickly as possible. Other data may include details of cargo on a heavy goods vehicle, the number of passengers on a bus or coach, and crash dynamics for a motorbike which may indicate the type of injuries the emergency services will have to deal with.

From 2018 in the EU all new cars will be required to have an eCall system fitted.

Sources

1. Connected and Autonomous Vehicles – The UK Economic Opportunity; KPMG LLP; March 2015; commissioned by the Society of Motor Manufacturers and Traders (SMMT)
2. United Nations Global Goals; www.globalgoals.org/

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