issue 03/2017

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INDUSTRY SPOTLIGHT

Brave new world of transport

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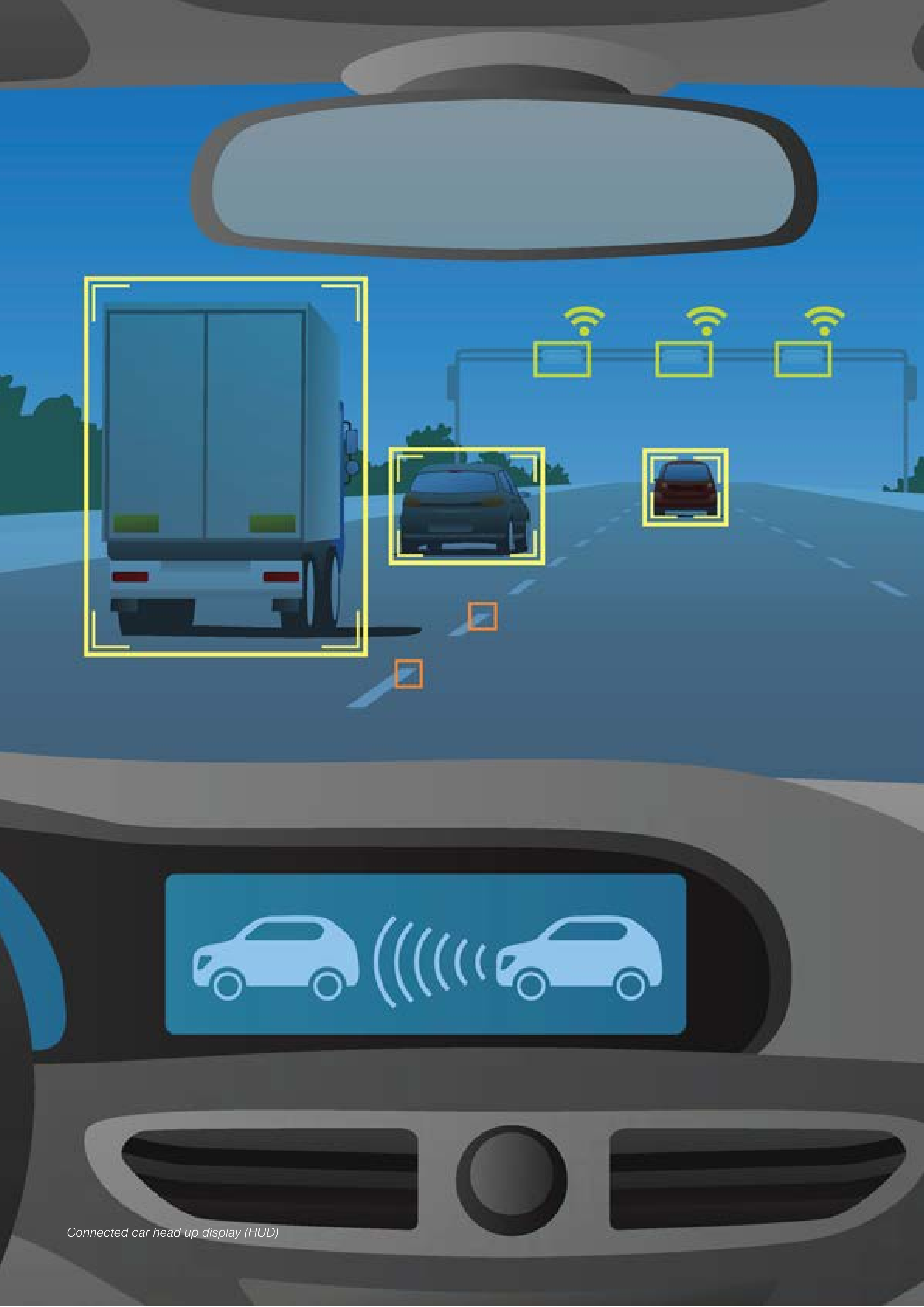


Connected car head up display (HUD)

To drive or not to drive?

The car of the future is already here

By Claire Marchand

Claire Marchand, Managing Editor e-tech

Imagine someone who hasn't driven a car in the past 30 years. Taking the wheel of a modern car today, this person would probably be lost trying to figure out all the electronics inside. Voice command, self-driving cars, and even GPS navigation were still sci-fi ideas in the 1980s…

CAVs are coming

The transportation sector has undergone, and is still undergoing drastic changes, especially road transport. Artificial intelligence is set to make our roads safer and more efficient; biometrics is bound to play a major role in facilitating vehicle access and security; machine vision and artificial intelligence also have a great future as the sector moves towards connected and autonomous vehicles (CAVs).

Cyber risks

As road vehicles become computers on wheels, communicate with other vehicles and receive traffic information, the protection of these onboard systems against malicious attacks is becoming a major security issue. It is a daunting task than cannot be achieved in the short term and which will need close and constant cooperation between a number of organizations, automotive and original equipment manufacturers (OEMs), software companies and security solution providers.

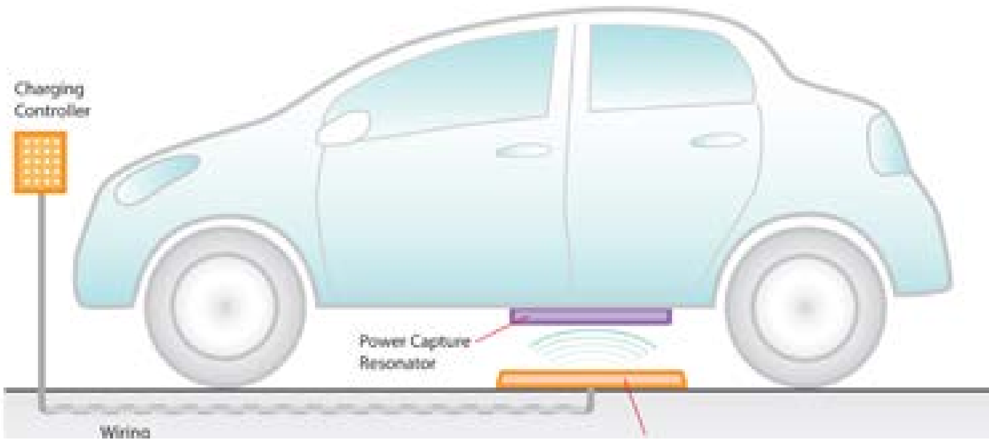
Efficient powering

The future of the automobile is leading towards energy efficiency. All automakers are now proposing hybrid, electric or fuel-cell vehicles in addition to regular fuel powered cars.

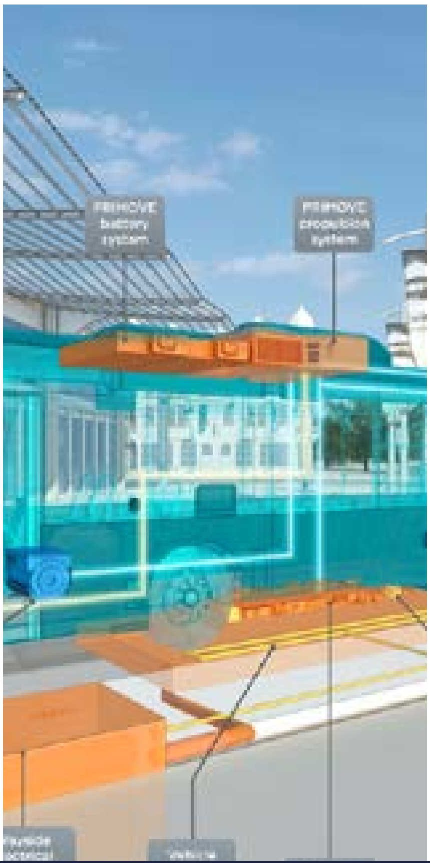
The number of electric vehicles (EVs) on our roads is growing but the main issues at stake remain charging and range. A few countries have already invested in the installation of enough charging stations to make sure EV drivers do not run out of battery power in the middle of nowhere. But much still has to be done to equip most of the world.

Wireless power transfer (WPT) to charge electric road vehicles is emerging as an attractive proposition in many cases, such as for urban transport. Several WPT projects are underway in Europe, the US and in Asia that allow bus fleets to recharge while driving or at bus stops along the way. WPT should also prove to be an asset in the development of the individual car market.

Standardization in these areas will require innovative approaches and working with other standardization bodies as the technologies bridge several areas.

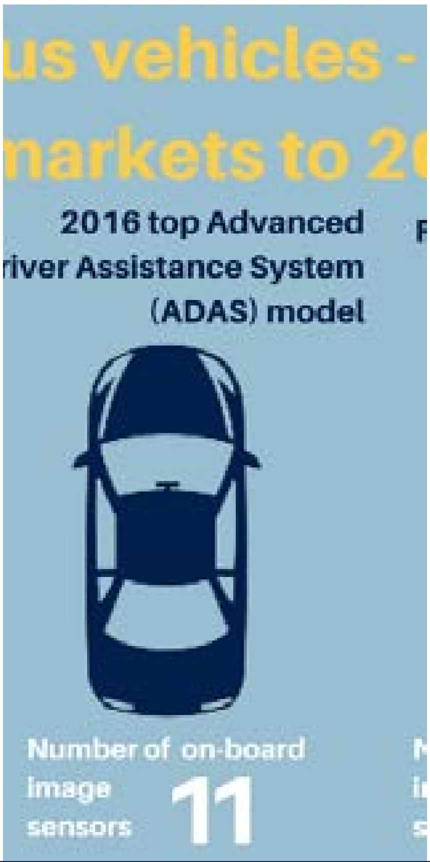


WPT: How magnetic resonance works (Infographics: WiTricity)



FOCUS OF THE MONTH - Transportation - Issue 03/2017

The transportation sector is undergoing drastic changes, especially road transport. Issue 03/2017 focuses on technologies such as artificial intelligence, biometrics, wireless power transfer, vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication and fuel cells. Standardization in these fields will require innovative approaches and working with other standardization bodies as the technologies bridge several areas.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Charging on the go

Wireless charging advances with IEC International Standards

By Clark Warrington

Each day buses log thousands of kilometers following routes on the streets of cities and towns around the globe. It may seem unremarkable, then, for a fleet of buses to have provided a total of 500 000 kilometers of service this January. But these are no ordinary buses…

No ordinary buses

The buses are wirelessly charged electric vehicles (EVs) that operate on routes in the German cities of Berlin, Braunschweig and Mannheim, as well as in Bruges (Belgium) and Södertälje (Sweden). They use PRIMOVE technology from the manufacturer Bombardier and their combined operation has resulted in reducing CO_2 emissions by more than 527 tonnes.

As with other wireless charging technologies, PRIMOVE is based on high-power inductive energy transfer. The transfer takes place between sending components that are buried beneath the road surface and receiving equipment that is installed beneath the vehicle. Devices installed along the roadside begin the contactless charging process as soon as the vehicle covers the charging segment.

Wireless charging stations are located in the depot, at end stops and along the route at selected stops where recharging can occur even as passengers alight.

The technologies behind wireless

At its heart, wireless power transfer (WPT) uses magnetic resonance coupling of air core transformers. This technology can provide a convenient, safe and flexible way to charge electric vehicles either while they are stopped or are in motion.

The power transfer system consists of a transmitter coil and a receiver coil. These coils form a system of magnetically coupled inductors. In operation, an alternating current in the transmitter coil generates a magnetic field. This in turn induces a voltage in the receiver coil. The voltage can be used to power a mobile device or charge a battery in an car, bus, truck or tram.

Another EV charging technology, more commonly encountered for now, is that of plug-in EVs (PEVs). Disadvantages of PEVs are their need for bulky and expensive cable-and-plug chargers as well as large and heavy batteries. The sheer bulk of the batteries can limit how far an EV reliant on this charging technology can travel, which may lead to some motorists suffering from the condition known as “range anxiety”.

The most common EV or hybrid EV power transfer systems usually charge at between 3 and 50 kW while the vehicle is turned off. This technology works well when charging at home or in parking garages.

By contrast, inductive power transfer – also known as dynamic wireless power transfer (DWPT) – both addresses range anxiety and allows for recharging while a vehicle is moving along a street.

The concept behind wireless charging is well known. In the late 19th century, Nikola Tesla was granted a patent for a resonant inductive coupling to supply electric current to streetcar motors from a stationary source.

More recently, in 2016, a 20 kW wireless charging system for vehicles was demonstrated at the US Department of Energy Oak Ridge National Laboratory (ORNL) in Tennessee where it achieved 90% efficiency while charging at three times the rate of a common plug-in system. Industry partners from Toyota, Cisco Systems, Evatran and Clemson

Electric hybrid bus wireless charging in Hamburg's downtown district (Photo: Siemens Press)

University International Center for Automotive Research contributed to the technology development.

The power electronics team from ORNL developed the charging system for passenger cars. It included an inverter, isolation transformer, vehicle-side electronics and coupling technologies. For the demonstration, researchers integrated the single-converter system into an electric Toyota RAV4 equipped with an additional 10 kWh battery.

IEC International Standards central to the adoption of EV WPT

Charging electric vehicles without using wires has the potential to replace conductive chargers because of its flexibility and convenience. The use of private and secure radio communications and standardization means that any vehicle would be able to charge at any location.

A number of IEC Technical Committees (TCs), Subcommittees (SCs) and Working Groups (WGs) are involved in the development of the International Standards necessary to the introduction of WPT.

The International Organization for Standardization (ISO) is also involved in the development of WPT through one of its TCs, which liaises with the corresponding IEC TC.

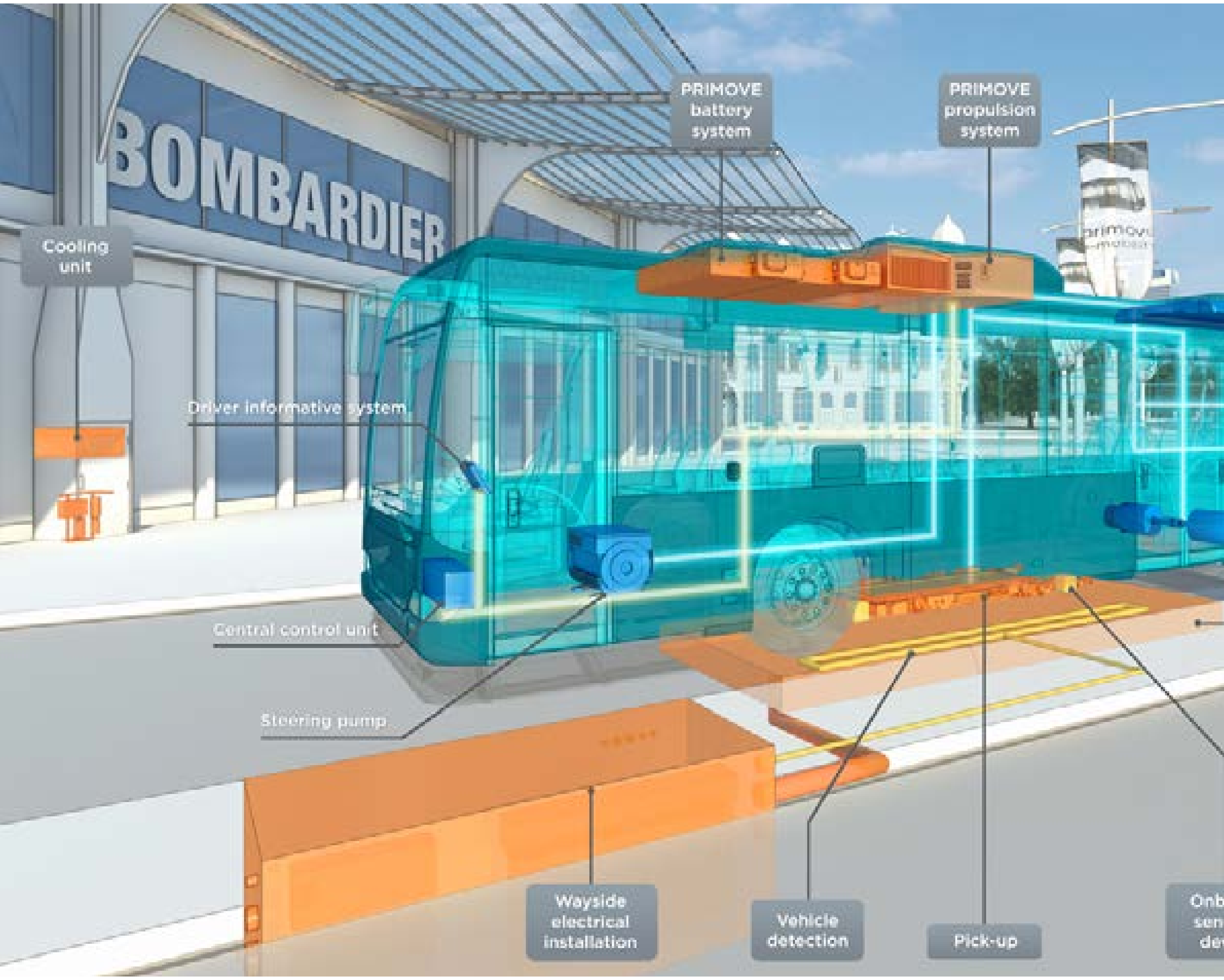
IEC TC 69: Electric road vehicles and electric industrial trucks, is responsible for preparing International Standards for "road vehicles, totally or partly electrically propelled from self-contained power sources and for electric industrial trucks".

IEC TC 69 has four Working Groups (WGs). One of these, IEC TC 69/WG 7, works specifically on "Electric vehicle wireless power transfer (WPT) systems".

IEC TC 69/WG 7 is working on IEC 61980, a three-part series of International Standards that applies to equipment used in WPT "from the supply network to electric road vehicles". This series also applies to WPT equipment supplied from on-site storage systems (such as buffer batteries and so on).

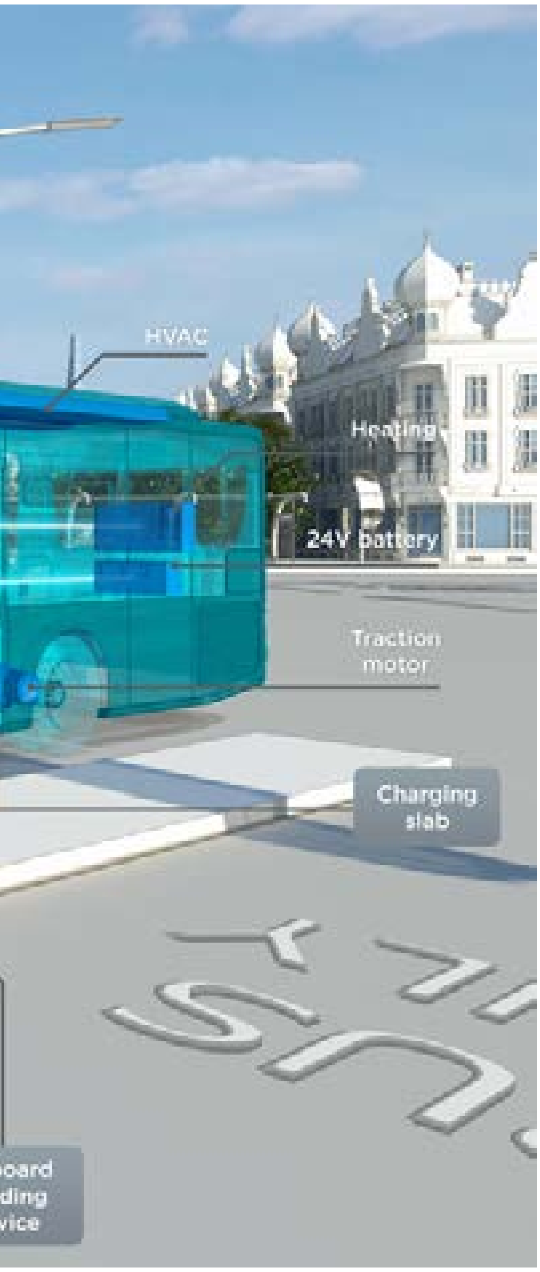
IEC 61980-1:2015, the first Standard published in the series, covers general requirements for EV WPT systems including general background and definitions – for example: efficiency, electrical safety, Electromagnetic Compatibility (EMC), protection from electromagnetic field (EMF) and so on. IEC 61980-2, part 2 of the series to be published later, will cover specific requirements for communication between electric road vehicles and WPT systems including general background and definitions.

As for the third part in the series, IEC 61980-3, also scheduled to be published later, it will cover specific



The technology behind the PRIMOVE wireless technology for buses (Photo: Bombardier/PRIMOVE) requirements for EV magnetic field wireless power transfer (MF-WPT) systems.

In addition, an SC of the International special committee on radio interference (CISPR) works on Standards related to WPT. CISPR/B (CIS/B): Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction, is involved in work on Amendment 2 Fragment 1 to CISPR 11:2015



Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement – Requirements for air-gap WPT.

The following IEC Technical Committees also maintain liaisons with IEC TC 69/WG7:

IEC TC 64: Electrical installations and protection against electric shock, and IEC TC 77: Electromagnetic compatibility.

ISO/TC 22/SC 37: Electrically propelled vehicles, a Subcommittee ISO/TC 22: Road vehicles, is also involved in WPT and maintains liaisons with IEC TC 69.

WPT expanding worldwide

Wireless charging technologies are in use in several places around the world.

In South Korea, the Korea Advanced Institute of Science and Technology (KAIST) has developed a WPT technology called OLEV, short for On-Line Electric Vehicles.

In the town of Gumi, a route has been built that allows buses to recharge while in motion. The technology supplies 60 kHz and 180 kW of power wirelessly to the transport vehicles. The route runs for a total of 35 km and the length of the DWPT section is 144 m made up of four DWPT sections.

Initially, two buses were equipped to recharge while driving over this roadway; the OLEV buses have coils on their underside to pick up power through the electromagnetic field on the road. The DWPT system enables the buses to reduce the size of the reserve battery used to one-fifth that of the battery onboard a typical electric car.

The UK government agency, Highways England, is carrying out test track

The Fraunhofer IISB (Institute) has developed a WPT system (Photo: Fraunhofer IISB)

trials of a wireless road-embedded EV charging technology. Analysis has shown that under different traffic conditions average demand could be as high as 500 kVA (0.5 MVA) per mile.

Highways England considered three types of road construction, including trench-based constructions, full-lane reconstruction and full-lane pre-fabricated construction. The first two methods were found to be viable, but analysis concluded that the full lane pre-fabricated method would probably be prohibitively expensive.

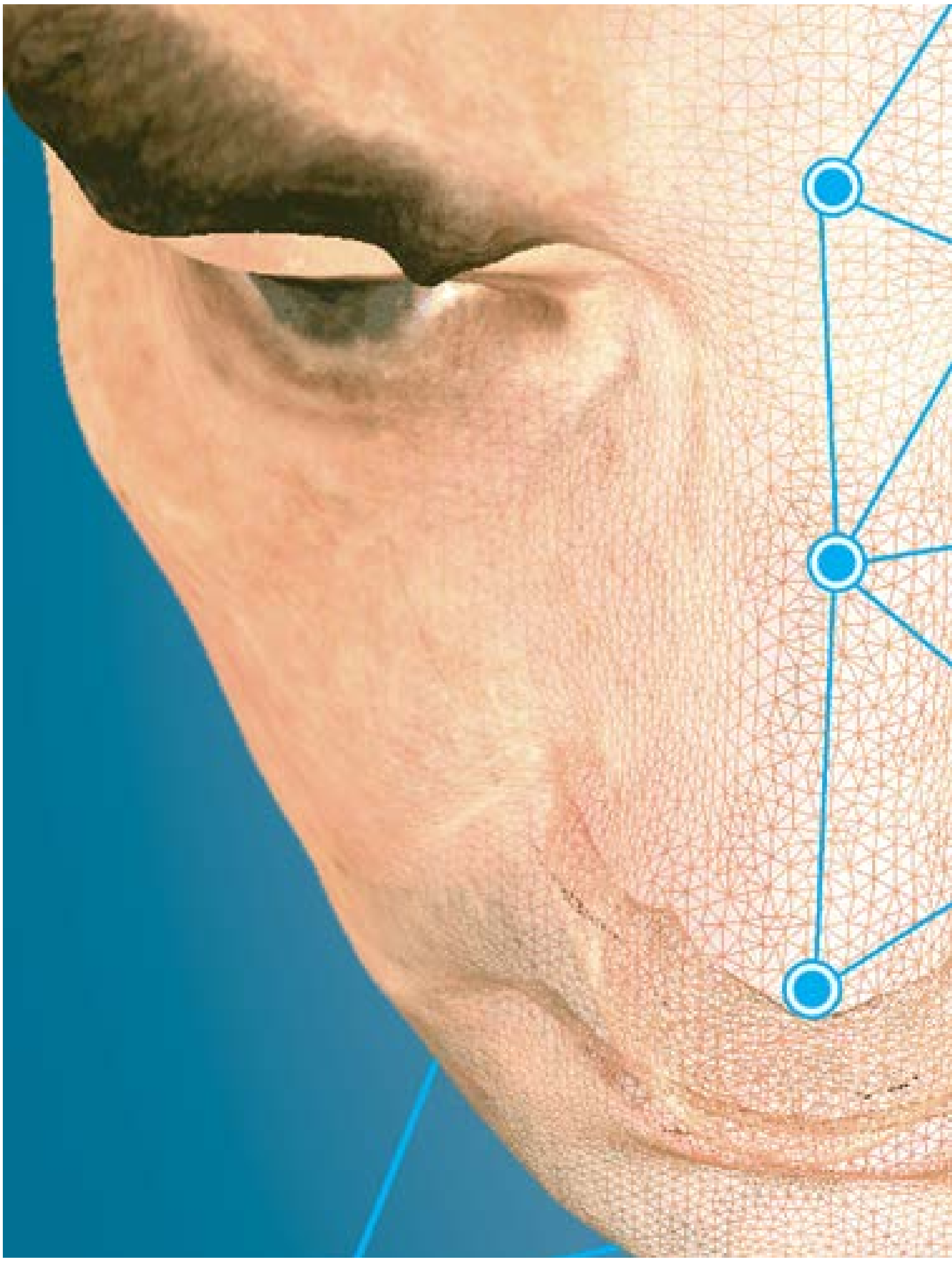
Whichever system will be used, International Standards developed by a number of IEC TCs and SCs will be central to the introduction of WPT to charge electric vehicles.

Biometrics for consumer markets

Electronic DNA facilitates vehicle access and security

By Antoinette Price

Fingerprint, palm, iris, voice, facial and gesture recognition will aid advances in driver-assistance systems and vehicle security. Incorporating cloud analytics will generate useful information and allow notifications to be sent during emergencies.



Fingerprint authentication increases car security, while facial recognition personalizes options (Photo: www.cont

Replacing your password with you

Biometrics have been used for decades by law enforcement and high-security facilities in their systems for identifying people and controlling access. These systems compare the behavioural and physical data which has been gathered and stored with the actual person wishing to gain access.

More recently, the scope has broadened to consumer markets. We can already access smartphones or tablets with a fingerprint or use voice recognition applications to authenticate online bank accounts.

Making it work with standards

IEC technical committees (TCs) and their subcommittees (SCs) produce International Standards for biometrics to help ensure reliability, quality and interoperability.

The Joint Technical Committee of the IEC and the International Organization for Standardization (ISO),

ISO/IEC JTC 1, covers information technology. The scope of ISO/IEC JTC 1/SC 37: Biometrics, includes specifications for the security, testing and reporting of different aspects such as data interchange formats, face image data, facial recognition, iris image data and voice command speech recognition.

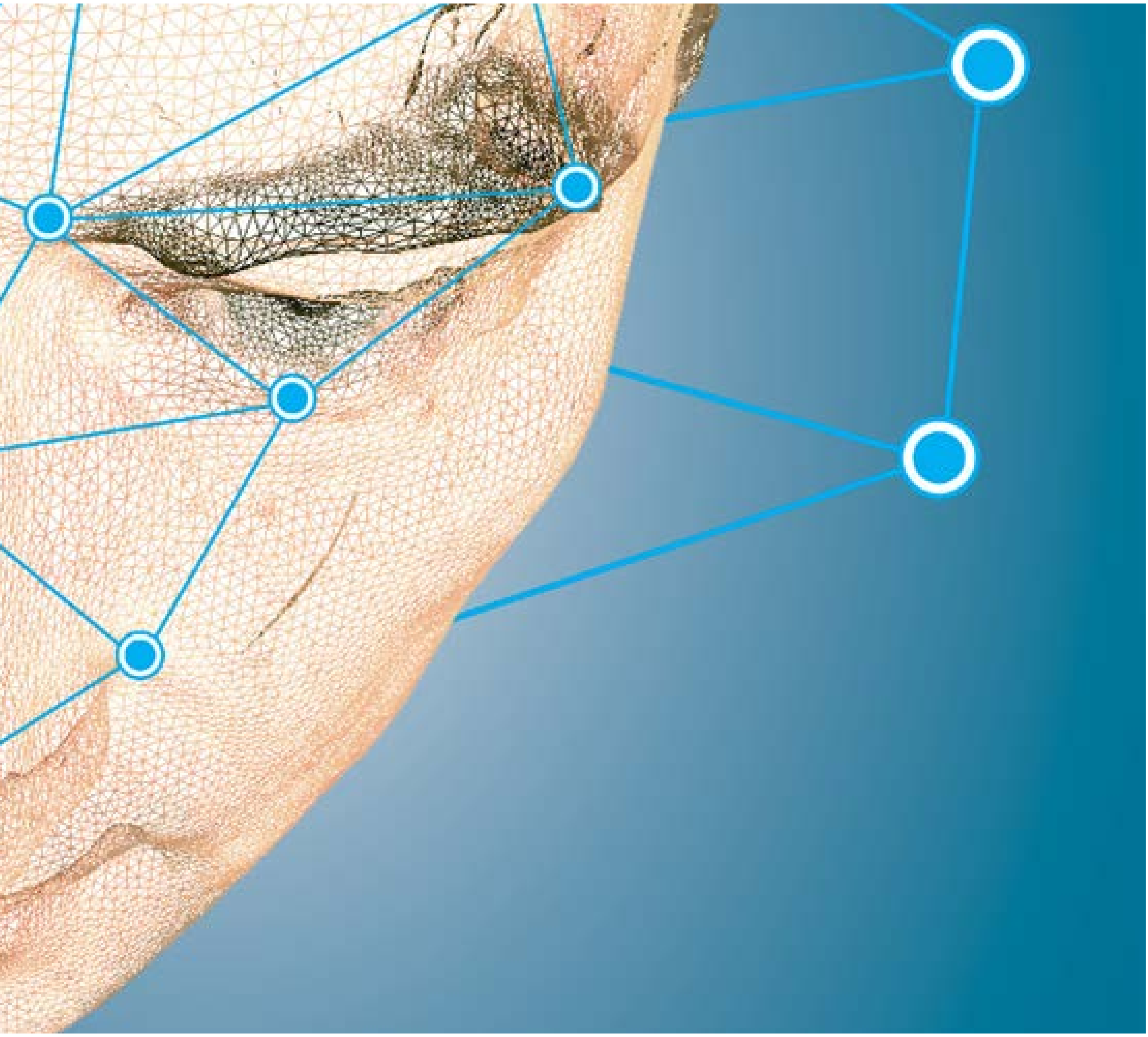
A fingerprint could be the key to your car

As cars become more connected and move towards being fully self-driving, the automotive industry is riding this trend too. A report by Frost and Sullivan says that one in three cars (almost 34 million passenger vehicles) will be using biometrics for identification and personalization by 2025.

High-tech security for vehicles

In 2016, a record number of tech companies partnered with car manufacturers, which increasingly are incorporating intelligent features into their newest vehicles. Research by Gartner estimates that a quarter of a billion connected cars will be on the road by 2020, offering various levels of automated driving and opening up the scope for new in-vehicle services. However, among the biggest challenges will be to secure the huge amounts of data such cars will produce and to protect passengers from hacking.

Many new cars are being developed with systems using biometrics which



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Human biometric traits are always present but PINs or passwords can be lost or forgotten (Photo: www.igd.fraunhofer.de)

are built-in or brought in through external services such as the cloud.

In the future, features that add another layer of security could include:

- Starting and operating future cars will require driver identification using a fingerprint sensor in addition to a key
- Other systems will recognize a driver's face before they enter the vehicle, which will only start if a pre-set driver profile is activated
- Iris recognition will be used to unlock the ignition, identify frequent users and automatically tailor the driving experience (seats, mirrors, infotainment preferences)

Taking driver safety to a new level

Synergies will be built up between car, insurance and health industries as advanced biometrics make future cars more secure. Though we are still years away from the day when cars will drive fully autonomously and humans no longer need to steer, the automobile industry is already developing ways to monitor driver alertness. For example, sensors in seat belts and covers could monitor drivers' heartbeats and alert them if they are about to have a heart attack, while eye trackers will detect drowsy drivers and give them time to pull over. The work of IEC TC 47: Semiconductor devices, covers the design, manufacture and use of sensors.

The advent of innovative health management devices, combined with aging populations, increased health awareness and the growing need to manage chronic diseases, is driving the boom in medical wearables. According to a report by Global Industry Analysts, the global market for medical wearables is expected to reach USD 4,5 million by 2020.

Against this backdrop, IEC has just established IEC TC 124 which will begin standardization activities for wearable electronic devices and technologies. These will include patchable materials and devices and implantable and edible materials and devices, as well as electronic textile materials and devices.

But what about identity theft?

While biometric data is unique to individuals and a logical choice as an element of access and control security, nothing is 100% safe and users will still need to be careful. Cards, passwords and personal identification numbers can be cancelled or changed if lost, misplaced or stolen, whereas fingerprints that have been lifted, copied and misused cannot. Additionally, biometric information is stored in databases which must be protected from all potential security breaches. If this technology is to become widespread, these issues will need to be addressed.

IEC takes cyber security and data privacy seriously. The software and hardware in cars will need to be protected. A number of ISO/IEC JTC 1 Subcommittees contribute towards mitigating such risks, for example ISO/IEC JTC 1/SC 27: IT Security techniques, including cloud services. High volumes of data will be exchanged between smartphone apps and intelligent car dashboards, which will also become an integral part of the Internet of Things. The work of ISO/IEC JTC 1/SC 6: Telecommunications and information exchange between systems, also contributes towards improving data security.

Energy harvesting 'feeds' road vehicles

New routes to cutting fuel consumption

By Morand Fachot

Recovering energy can offer attractive solutions for providing additional power to motor vehicles at the same time as cutting their fuel consumption and emissions. They rely on a number of systems that recover thermal, kinetic, or other forms of energy (such as solar) that would either be lost or not used in vehicles.

Use extends increasingly beyond small devices

Energy harvesting is no longer perceived as limited solely to powering small devices such as sensors for Internet of Things (IoT) and wearable or medical devices. New uses are emerging in demanding energy-intensive sectors such as road transport, in particular when associated with innovative or improved storage systems.

In spite of greatly improved fuel consumption, internal combustion engines (ICEs) are still inefficient, wasting 55-65% of the thermal energy of the fuel they burn.

Various forms of energy recovery can improve significantly the overall efficiency of road vehicles, making them less dependent on fossil fuels and cutting emissions of noxious gases.

Urban public transport offers the greatest potential for energy recovery. Not only can it provide additional power but in some cases can even replace the use of fossil fuels entirely.

The same applies to private vehicles, albeit to a lesser extent.

Multiple forms of recovery

Various sources of energy can be recovered to power road vehicles, or some of their systems. The sources, some of which would otherwise be wasted, include:

- Kinetic energy, recovered through regenerative-charge braking and energy-harvesting shock absorbers. It can be converted into electric power used in full or hybrid electric vehicles (EVs) to charge the batteries and capacitors/supercapacitors that provide extra power and/or support functions such as start-stop or short electric drive. The kinetic energy from regenerative-charge braking and energy-harvesting systems can also be stored in flywheels for near instantaneous redirection to a powertrain or for powering electric motors.
- Heat recovery from exhaust gases is another interesting solution that

Thermoelectric generator (TEG) installation in exhaust system of BMW saloon can improve overall vehicle fuel economy and cut noxious gas emissions from ICEs. Energy from the hot engine exhaust, which would otherwise be wasted, is converted into electrical energy using thermoelectric generators (TEGs). This additional energy can be used to power the growing number of accessories, such as onboard communication and navigation systems, which rely on power provided by engine-driven alternator/generators and increase fuel consumption. The efficiency of TEGs is currently not very high (around 5%), but improvements are on the way and efficiency is expected to increase to around 15% as materials advance. TEGs can also be used to transfer waste heat to either heat or cool (the latter through heat transfer) the engines and occupants of cars. Racing cars have been using motor generator unit-heat (MGU-H) for some time, recovering energy from exhaust heat to power other systems including the motor generator unit-kinetic (MGU-K), which converts kinetic energy generated under braking into electrical energy (rather than letting it be dissipated/ wasted as heat). TEGs rely on the use of semiconductor devices; International Standards for these are being prepared by IEC TC 47: Semiconductor devices.

- Energy harvested from the sun also offers attractive possibilities. Experimental vehicles that draw all their energy from the sun, such as the Nuon Solar, have already proven that this technology is viable. More recently, a leading Japanese car maker has introduced a new model of one of its hybrid EVs with a rooftop photovoltaic (PV) option that provides additional power. According to a report in PV Magazine, the "PV panels also supply power to the traction battery while the vehicle is parked, providing enough of a charge to drive up to a maximum of 6,1 kilometres per day, or an average of 2,9 kilometres (…) In addition, the solar panels generate electricity for the vehicle's lights, power windows and air conditioning systems".
- Thin-film flexible PV panels present interesting opportunities for the fitting of PV energy systems to road vehicles. IEC TC 82: Solar photovoltaic energy systems, develops "International Standards for systems of photovoltaic conversion of solar energy into electrical energy and for all the elements in the entire photovoltaic energy system".

Recovered energy must be stored, somehow…

Energy recovered from heat, kinetic or solar sources needs to/can be stored in chemical, electrostatic, or kinetic form to be delivered either nearly instantaneously or later.

Secondary (rechargeable) batteries are the most mature, widespread and best-known energy storage (ES) system for automotive applications. They were first introduced in lead-acid chemistry in the 1860s. In batteries, electrochemically-active material is used to store electrical energy. In addition to lead-acid, other battery chemistries, such as lithium-ion and nickel-based ones, are finding applications in full or hybrid EVs.

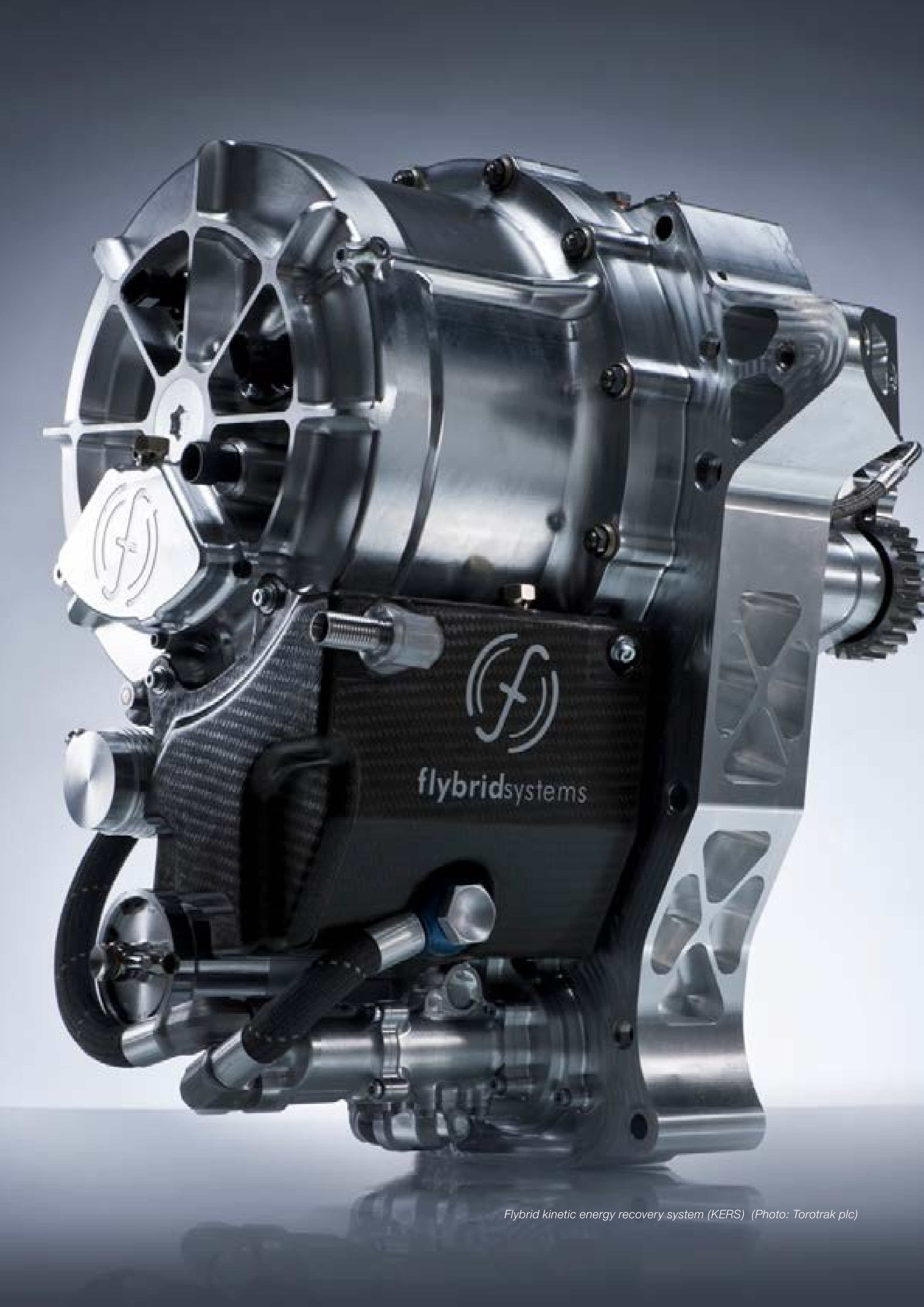
IEC TC 21: Secondary cells and batteries, prepares "product standards for all secondary cells and batteries, irrespective of type or application. The requirements cover all aspects depending on the battery technology such as: safety installation principles, performance, battery system aspects, dimensions, labelling. All electrochemical systems are considered".

Another useful ES system in automotive applications relies on capacitors, which store electrical energy electrostatically on the surface of the material rather than chemically as batteries do. Capacitors can capture energy over a very brief period, such as during braking phases, and release it quickly to boost power or for other uses. In supercapacitors (or double layer capacitors), the electrostatic charge is stored in an electrochemical double layer. IEC TC 40: Capacitors and resistors for electronic equipment, prepares International Standards for these.

Kinetic energy that would be lost as heat during braking can also be recovered and stored in mechanical form by accelerating a flywheel via continuously variable transmission (CVT). This energy can be released back to the powertrain by the CVT upon acceleration.

Flywheels are spun at very high speeds, sometimes in excess of 60 000 rpm, and are contained in robust casings in case of failure. This so-called kinetic energy recovery system (KERS) was introduced first in racing cars, but is now being tested for hybrid production cars, notably by a renowned Swedish car manufacturer, which claims that the Flybrid system being tested in one of its models under development delivers up to 30% more power than conventional equivalent models, with a 25% boost in fuel efficiency. Since 2014, some 500 London buses have been equipped with GKN Gyrodrive hybrid power flywheel systems, resulting in fuel savings of over 20% over a two-year period and significantly cutting bus pollution.

Some or all of these energy recovery and storage processes and systems are set to be installed into further full and hybrid EV cars as well as in vehicles that rely mainly on ICEs for propulsion. They all rely to a significant extent on the International Standards being developed by a number of IEC TCs.



Flybrid kinetic energy recovery system (KERS) (Photo: Torotrak plc)

Are we driving or ride sharing?

Reshaping personal transport and the automotive industry

By Antoinette Price

In the next decade, cars will be well on the way to, or have reached the goal of becoming fully self-driving. As the industry continues to develop new levels of autonomous vehicles, the whole notion of personal transport is being turned on its head.

The rocky road to safe autonomous vehicles

We often hear from road traffic regulators and the automotive industry that advanced technology, including artificial intelligence (AI), will make our roads safer and more efficient as a result of intelligent infrastructure and fully functioning autonomous, connected cars. There will also be reduced pollution and congestion, no more parking hassles and time for passengers to engage in other activities while their vehicles do all the driving. In theory, this sounds great.

In practice, however, it is far more complex to realize than to theorize, and this utopian scenario is still a long way off. More work still needs to be done to ensure cars are able to recognize objects that cross their path as well as to handle different weather conditions and all the possible outcomes already mentioned.

Recently another accident reported in the US ended in a self-driving car being flipped on its side. While this car was not at fault, it highlights an important issue in the transition to autonomous cars: roads will be filled with a combination of human-driven and driverless vehicles. Not only will humans and algorithms react differently to the same road situation, most people will not accept this technology unless it functions perfectly and is secure from cyber threats.

Several Subcommittees (SCs) of the Joint Technical Committee of IEC and the International Organization for Standardization, ISO/IEC JTC 1: Information technology, are working towards increasing the security, and therefore the safety, of connected cars. Telecommunications and information exchange between systems, comprising near field communications, are covered by ISO/IEC JTC 1/SC 6, IT security techniques, such as lightweight cryptography for vehicles, come under ISO/IEC JTC 1/SC 27, while ISO/IEC JTC 1/SC 38 deals with the cloud computing used in some cars to process, analyze and store the large amounts of data being gathered. Find out more about IEC cyber security work in the article *Protecting road*

VW Sedric is a battery-electric, fully-autonomous pod (Phot *vehicles from cyber attacks* in this edition of *e-tech.*

The next major disruptive technology

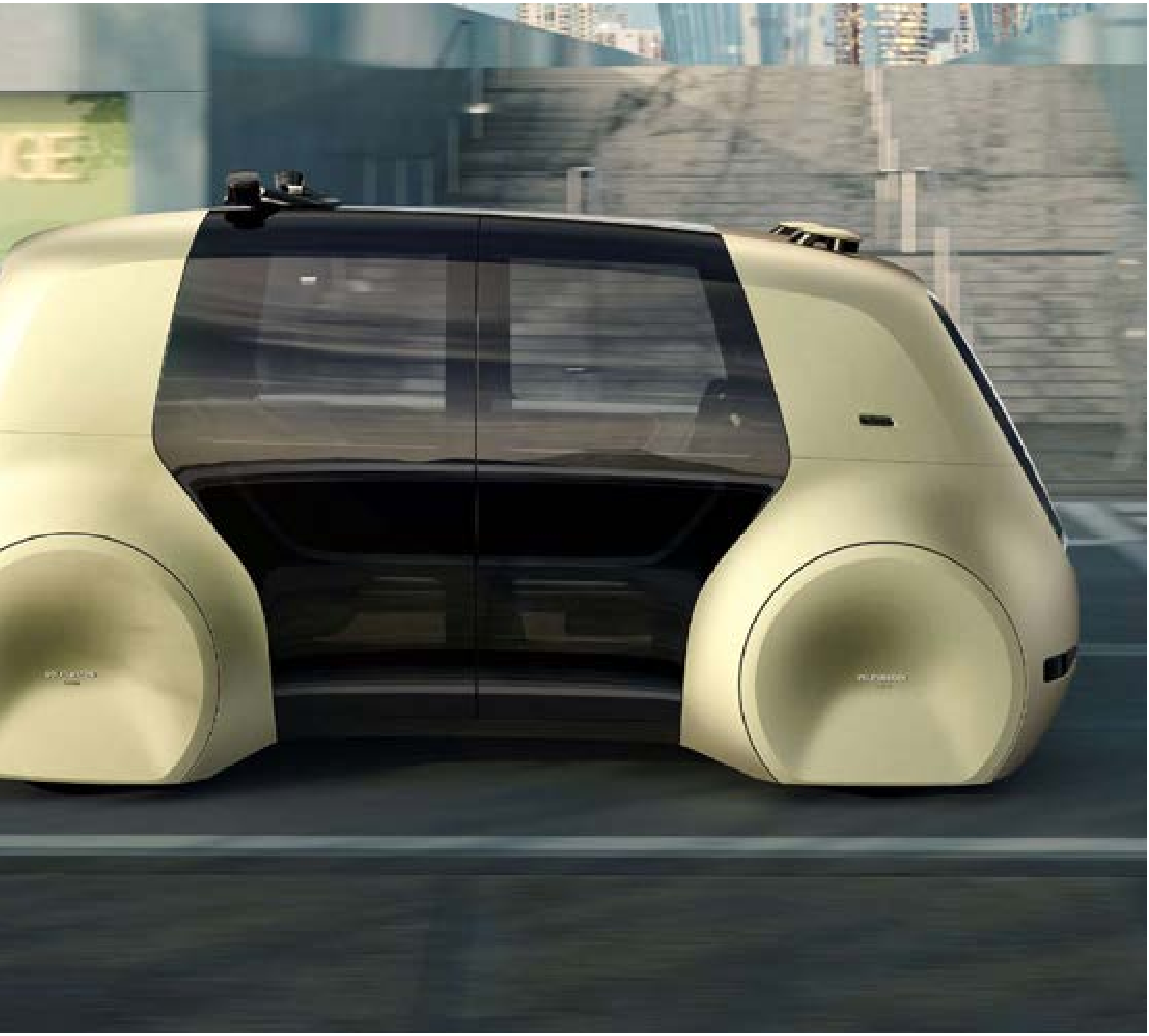
From healthcare and manufacturing to finance and customer service, many industries are being transformed by artificial intelligence (AI). A market research report by Tractica forecasts that the annual global revenue for AI products and services will be worth USD 36,8 billion by 2025.

Behind AI is a relatively new computing model called deep learning. Powerful graphics processing units (GPUs) allow machines to learn, by gathering and analyzing huge amounts of data, in order to enable them to make autonomous decisions.

As this technology advances, numerous smart sensors, embedded connectivity applications and location-based big apps related to the running of the car and to its surroundings (other vehicles, pedestrians, traffic and weather updates), will gather data. These will then be exchanged and used throughout the intelligent road infrastructure to improve road safety and efficiency.

Standardization every step of the way

A number of IEC technical committees (TCs) and their SCs produce International Standards which contribute towards ensuring the safety, reliability and interoperability of car



o: Volkswagen)

AI technology enables cars to recognize faces and other vehicles (Photo: https://www.sighthound.)

components. Some of these include lamps and related equipment (IEC TC 34), sensors (IEC TC 47), EV charging (IEC TC 69), audio, video and multimedia systems and equipment, such as dashboard touchscreens (IEC TC 110). Additionally, IEC International Standards for cyber security will be applicable to the software and hardware in connected vehicles.

AI could enhance road safety and efficiency

Deep learning, combined with biometrics, is already changing the driving experience. Some smart cars know the drivers before they get in, thanks to pre-programmed facial recognition apps, while others require fingerprint authentication in addition to a key to start the motor, adding a layer of security. For more information about biometrics and connected cars, read *Biometrics for consumer markets* in this edition of *e-tech.*

Many new cars already contain AI technology, which can enhance safety and security; for example, driver assistance systems, automatic braking, smart cruise controls, pedestrian and cross-traffic alerts as well as collision avoidance systems. Facial recognition and external car sensors track external objects or pedestrians, while voice recognition alerts drivers to the presence of the objects that have been detected.

The automotive industry is working towards fully connected cars being able to talk to one another using vehicle to vehicle (V2V) technology, and to intelligent traffic systems through vehicle to infrastructure (V2I) technology. As a result of this interaction, cars will adjust speeds and general driving automatically so as to suit the surroundings. Increased communication, access to real-time traffic and weather conditions and knowing what drivers in the immediate vicinity and further away are doing, will – hopefully – lead to safer, more efficient roads.

Research by Gartner suggests that by 2020, there will be 250 million connected vehicles on the road. This connectivity could open the door to an endless list of in-vehicle services. For example, they may include intelligent car assistants who can find the nearest parking (read more in article *Smarter than the average lamppost* in this issue of e-tech) or advise passengers of the closest restaurants, petrol or charging stations or shopping facilities. Apps which offer real-time engine monitoring will be able to flag up potential issues, send a message to the nearest garage and arrange repairs as rapidly as possible, thereby avoiding and minimizing the effects of mechanical breakdown.

Nothing works without connectivity

Even if all of these apps and services are developed, using Wi-Fi, LAN or the cloud, they will only work if they are connected to the Internet of Things (IoT). The IoT will allow the requisite vital exchange of information between apps within the car and external service providers and infrastructure networks.

The work of ISO/IEC JTC 1: Information technology, covers “the specification, design and development of systems and tools dealing with the capture, representation, processing, security, transfer, interchange, presentation, management, organization, storage and retrieval of information”.

A growing number of consumer devices and systems are becoming part of the IoT. In light of this, ISO/IEC JTC 1/SC 41 has recently been established to develop International Standards for IoT and related technologies.

Discussing the future networked car

During the 2017 Geneva Motor Show, a workshop for the Future Networked Car was organized by the International Telecommunication Union (ITU) and the United Nations Economic Commission for Europe (UNECE). Regulators, standardization and certification organizations as well as automotive industry, technology and cyber security experts gathered to discuss the changes that AI and

machine learning will bring to vehicles and transport, different aspects of connected vehicles and automated driving and how to mitigate cyber security threats.

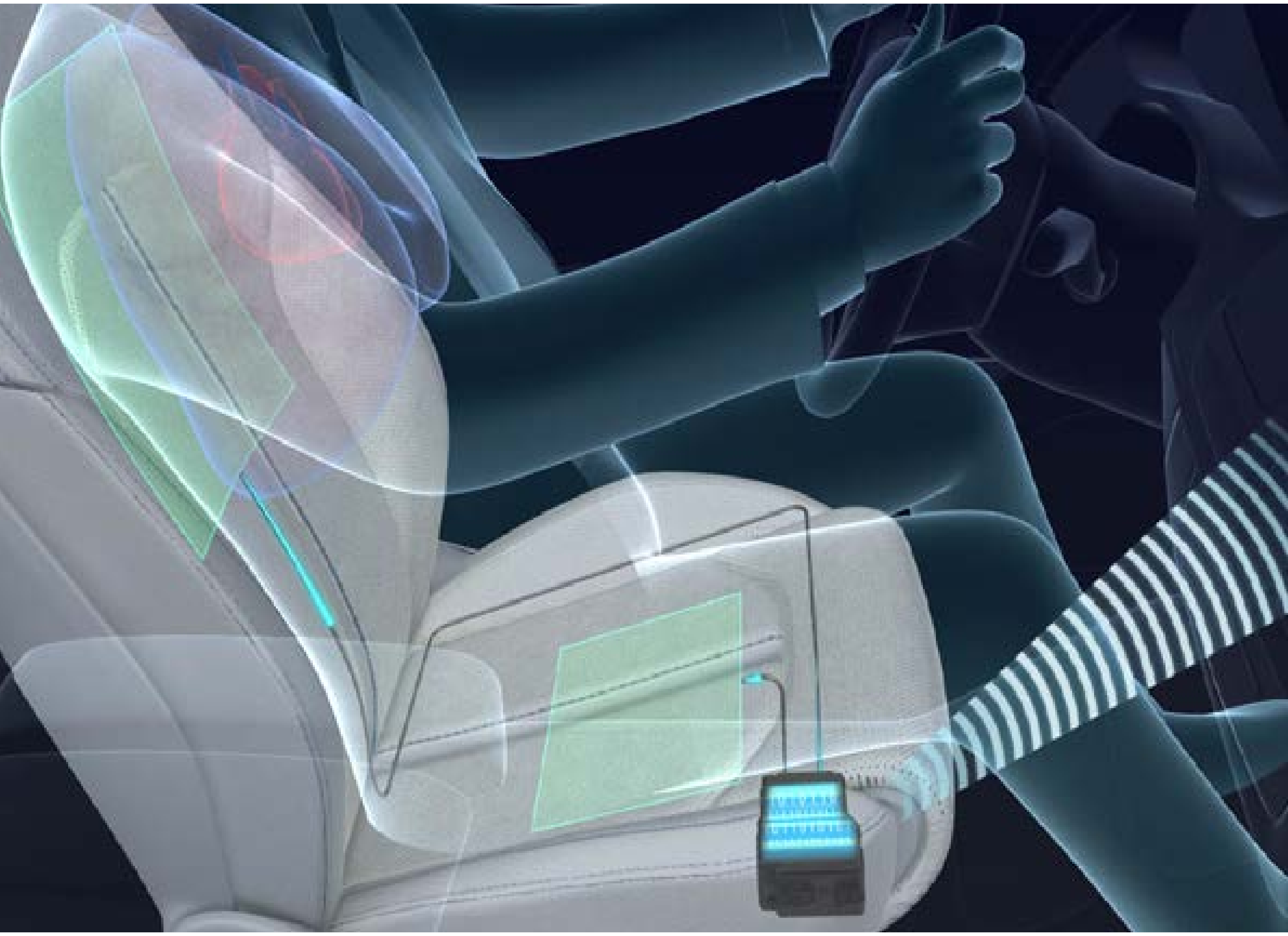
Automotive industry: back to the drawing board

As well as affecting how cars run, AI technology is contributing towards changing the driving experience radically and forcing the automotive industry to rethink its business model for personal transport. This evolution was highlighted during the workshop.

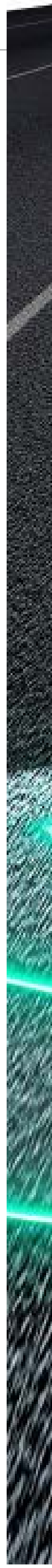
Against the backdrop of increases in aging populations, car running costs, pollution, congestion and parking inconveniences, there is a very strong case for reassessing personal transport, particularly in urban areas. "We are considering new business models that would merge individual mobility and public transportation", said Anders Eugensson, Director, Governmental Affairs, Volvo Car Group, Sweden.

Eugensson went on to explain the possibility of running fleets of cars for ride-sharing services, allowing people to use a vehicle without owning it. Another option would be to offer peer-to-peer sharing: participating car owners rent out their cars when they are not using them. Renters access nearby and affordable vehicles and only pay for the time they use them. Increasingly, cars are driven by technology, and car manufacturers are considering new business services such as ride sharing instead of focusing solely on selling cars. As a result, in the last couple of years, many partnerships have been formed between automobile makers and tech companies.

Data gathered by CB Insights shows that 2016 was a record-breaking year for partnerships between tech companies and car manufacturers, amounting to a total of USD 450 million invested across 33 corporate groups.



Faurecia and Stanford University develop active wellness car seat which measures heartbeat and stress levels (Photo: http://static5.businessinsider.com)



Protecting road vehicles from cyber attacks

The automotive industry wakes up to cyber threats, and considers measures to thwart them

By Morand Fachot

Critical infrastructure systems are being increasingly targeted by sophisticated cyber attacks. A session of the annual Future Networked Car symposium, organized by the International Telecommunication Union (ITU) and the United Nations Economic Commission for Europe (UNECE) on the fringe of the Geneva Motor Show, looked at measures aimed at mitigating cyber security threats to automotive systems. A wide range of speakers took part, including government representatives, car and accessory manufacturers, automotive cyber security solutions developers and providers.

National security concern

Government and local authorities are concerned by threats to transportation systems, on roads and elsewhere.

Darren Handley, from the British Department for Transport (DoT), told participants that the automotive industry faced three main sets of challenges:

- Cultural: cyber security is new to the industry, and it needs to get the right structures and organization in place to make cyber security business as usual.
- Technical: added complexity resulting from the long development time and life cycle of vehicles; management of risks in the supply chain and interactions with third parties (such as after market telematics devices)
- Governmental: there is no regulatory framework for what manufacturers should do. However, Handley said, standardization bodies like the International Organization for Standardization (ISO), ITU, the Society of Automotive Engineers (SAE), and IEC and ISO in their Joint Technical Committee ISO/IEC JTC 1: Information technology, are producing initial guidance in this area.

The DoT's approach is to ensure that "the UK transport sector remains safe, secure and resilient in the face of cyber threats, and able to thrive in an increasingly interconnected, digital world". The DoT wants to ensure an appropriate level of protection for vehicles, and the road side infrastructure they talk to, from unauthorized access, control or interference

The DOT's aims in support of this, Handley said, are to:

- Understand the cyber threat and the vulnerabilities for the transport sector
- Mitigate cyber risks and take appropriate action to protect key assets
- Respond to cyber incidents effectively and ensure that lessons are learnt
- Promote cultural change, raise awareness and build cyber capability

Actions under way in this area include:

- Promotion – by initiatives like the automotive information exchange hosted by UK's National Cyber Security Centre (NCSC) and Centre for the Protection of National Infrastructure (CPNI) in February 2017; promotion of cyber security principles for connected autonomous vehicles (CAV) in April 2017.
- Mitigation – through collaboration on cyber security for connected corridors with EU partners; chairing a task force on cyber security within the UNECE World Forum for the Harmonization of Vehicle Regulations (draft paper 2018)
- Response – Provide incident response and reporting mechanisms through NCSC/CPNI Cyber Incident Response (CIR) scheme (2017)

Connected cars are becoming real computers on wheel...

Testing and certification body perspective

Dirk Schlesinger, Chief Technology Officer of TÜV SÜD, an international testing, inspection, auditing and certification service provider, highlighted the challenges faced by the industry saying that "the car of tomorrow was a PC on wheels, but much more challenging". Schlesinger mentioned Windows 10, which has 27-50 million lines of executable code, and a total of 100 million lines of code when motherboard, graphics card and applications such as Office are included. However, he noted Windows 10 doesn't have any sensor and everything is in one place.

By comparison, he said, a Ford GT supercar has 50 different sensors in 15 sensor sets, 28 microprocessors, 6 communication area networks (CANs), 3 000 different signals delivering the equivalent of 100 GB /hour of data.

The challenge is to get all the signals to talk to each other while making sure "when one sensor shuts down it doesn't crash the whole system", he said. The car has 10 million lines of "mission critical" software code, that is three million more than a Boeing 787 and eight million more than an F-22 fighter aircraft, and "rebooting while driving is not an option", he added.

"Always assume you are in a hostile network with a multitude of attack vectors", Schlesinger said. He named today's vectors as onboard audio systems, smartphone apps, communication intercepts, such as keyless entry, tyre pressure sensors, and direct network access, via rearview camera or breaking off a mirror. Tomorrow's vectors will be IT-infrastructure of dealer/repair shop, original equipment manufacturers/ service providers (OEM/SP) data centres, and other elements of the digital delivery chain.

Software protection and quality control become increasingly important, but existing standards are not sufficient, Schlesinger stressed recommending that the quality of commonly used software libraries/open source software is ensured without stifling innovation.

He warned that relying on just gateway(s) and anti-virus wouldn't help, and said that a holistic view of cyber security was needed with a convergence of IT and Operational Technology (OT), similar to that found in manufacturing automation. Referring to SAE J3061, he said that this standard was auto-specific, but he raised issues such as OEM data centres, the qualification of system integrators, and security processes innovation.

Looking for software solutions

Arnaud Taddei, Director of Security Solutions Architecture and CTO at Symantec, presented the company's approach, which consists in building comprehensive security into cars. This approach is outlined in a White Paper.

For Symantec "technology exists to solve many of these security problems, the challenges of deploying such technology in cars loom far larger than similar challenges do in traditional IT systems. In traditional IT systems, most problems can be solved with a quick install, update, or configuration change," or more radical measures to tackle very sophisticated threats. But "cars don't work like that," as they don't get "the weekly, daily, and real-time security updates that IT teams enjoy."

Symantec recommends "scalable approaches to building-in security". These "require discipline and collaboration in applying the following basic security principles:

- Protecting all communications
- Protecting each sensor, actuator, microcontroller (MCU), and microprocessor
- Safely and effectively managing the entire vehicle over the air (OTA)
- Mitigating advanced threats."

The automotive sector faces some significant challenges Symantec notes: it needs long certification lead times for safely introducing any new technology. But the situation is urgent, neglecting the issue could cause fatalities, as could phasing in technology too quickly.

Solving this "large and complex problem requires the insights and efforts of companies in both the automotive industry and IT and OT security. Designing cars that are secure from end to end will take time, and both industries must begin addressing these security issues at every tier of the automotive value chain," according to Symantec.

Protecting cars against cyber threats requires discipline and collaboration in applying basic security principles at each level of the system.

Symantec lists "Four Cornerstones" for this:

- Protecting communications: particularly any modems for in-vehicle infotainment (IVI) or in on-board diagnostics (OBD)
- Protecting each module: sensors, actuators, and anything with an MCU
- OTA management: from the cloud to each car
- Mitigating advanced threats: analytics in the car and in the Cloud

"Long-term, comprehensive security will require building security into the car at each layer. Today's cars have a great number of layers. (…). Protecting the whole "stack" from top to bottom with comprehensive security will take many years, given the complexity of spanning supplier relationships", notes Symantec, which offers sets of technologies to address these challenges.

Enabling secure connected vehicles

Yoram Berholtz, Business Development Director for automotive cyber security company Argus, which provides in-vehicle network-wide security by detecting attacks, suspicious activity and changes

Connected cars are becoming real computers on wheel, vulnerable to cyber attacks

Concept of car cockpit in self-driving mode

in standard in-vehicle network behaviour, stated that, deployed centrally, Argus In-Vehicle Network Protection examines entire network communication and stops attacks advancing in the network.

By next year there will be 100 million cars on the roads, Berholtz said.

Possible attack scenarios include cyber ransom, car theft, targeted attacks to provoke accidents, data theft/privacy invasion, and mass events (accidents).

Nearly all major brands have been hacked, Berholtz noted, giving examples of these and of recalls of vehicles found to have vulnerabilities.

He outlined "Argus cyber security philosophy", which relies on:

- Prevention: making it as hard as possible to attack
- Understanding: knowing you are being hacked and how in real time
- Response: Mitigating the damage and immunizing the fleet in hours

Prevention rests on:

- In-vehicle protection: via electronic engine control unit (ECU) protection, in-vehicle network protection and connectivity protection
- Out-of-vehicle lifespan protection and aftermarket protection

Understanding depends on real-time monitoring of fleets to identify vulnerabilities, attacked component, block attacks and unauthorized access

Response is achieved by delivering security updates over the air.

Long-time task that requires close cooperation between organizations

Protecting road vehicles against cyber threat is a daunting task than cannot be achieved in the short term and which will need close and constant cooperation between a number of organizations, automotive and original equipment manufacturers (OEMs), software companies and security solution providers.

The IEC, working within ISO/IEC JTC 1, plays its part in this overall architecture, as shown in the UNECE document on *System Security Principles for Intelligent Transport System and Connected and Automated Vehicles.*

This document lists no less than 11 ISO/IEC JTC 1 applicable Standards and guidance documents, together with two SAE standards: SAE J3061, *Cybersecurity guidebook for cyber-physical vehicle systems* and SAE J3101, *Requirements for hardware protected security for ground vehicle applications*, and four NIST documents.

Battle for the connected car

Car manufacturers and telecoms operators disagree on the future for connected cars

By Catherine Bischofberger

Automotive giants and telecoms outfits must work together to make way for the connected car but they have opposing views of how it should come about. One of the friction points is cyber security. The IEC is working with the International Organization for Standardization (ISO) on standards addressing this issue.

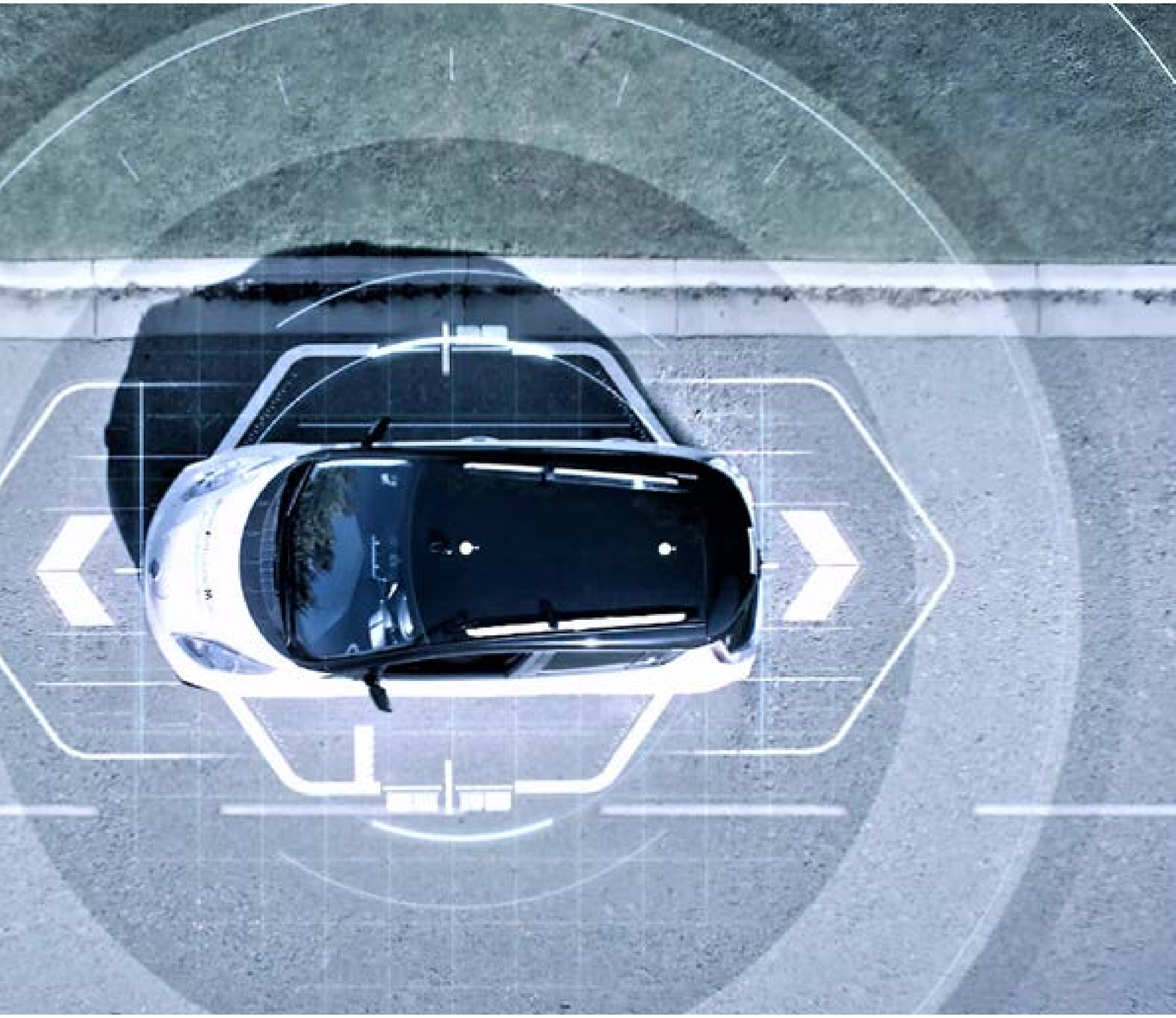
The car and the telecoms industries have diverging working cultures, which is in part due to their history. While automotive manufacturers revolutionized the 20th Century, telecoms companies enabled the Internet age. One of the main differences lies in their respective concepts of time.

Telecoms products are updated on a monthly basis, while car makers take several years to launch new models. It is hardly surprising, then, that the auto crowd views the "telco" newcomers with a certain amount of suspicion, especially as the business of cars is so closely intertwined with the notion of safety. Smash your phone and you will lose your contacts, smash your car and you risk losing your life. The stakes are not the same and automotive companies are not altogether convinced that telecoms operators have fully grasped the issue.

Testing, testing…

Several European initiatives are forcing them to bang heads together as, increasingly, the future for vehicles looks automated and self-driving. One of them is UK CITE (connected intelligent transport environment), which has rounded up a wide number of car companies and telecoms operators together with Coventry City Council, Coventry University and Highways England Company. The project aims to create an advanced environment for testing connected and autonomous vehicles and involves equipping up to 40 miles of urban roads and motorways with four different "talking car technologies". One of the goals of the project is to see how the technologies help reduce traffic congestion while providing entertainment and safety services through better connectivity.

Another similar venture is taking place in France. Named Scoop@F, the pilot project involves 3 000 vehicles running on 2 000 km of roads, in different areas of France, the Ile de France and the East Corridor running from Paris to Strasbourg, as well as in Brittany, Bordeaux and Isère.The second part of Scoop@F is more specifically dedicated to cross border



Autonomous driving tested by Renault-Nissan Alliance CEO Carlos Ghosn (Photo: Nissan)

tests with other EU member states (Spain, Portugal and Austria). It aims to develop a hybrid communication solution running on 3G, 4G and ITS G5 networks.

The idea behind the tests is to stimulate the cooperation between automotive manufacturers, telecoms and road operators and exchange on innovation and best practice. Scoop@F aims to validate the EU-backed C-ITS (Cooperative Intelligent Transport Systems) platform launched in July 2014, which itself vows to build interoperability at European level for a certain number of services, such as hazardous location notifications, information on fuelling and charging stations for alternate fuel vehicles, etc…

As the Head of Connected Car at Orange Business Services Car, Julien Masson, explained at a joint ITU-UNECE conference on the future of the networked car held during this year's Geneva Motor Show: "Vehicle to vehicle communications is one of the ways to help autonomous cars to change lanes on highways, which remains a big problem for self-driving technology. Although scalability issues still have to be addressed as well as interoperability problems as soon as you cross the borders."

A third initiative is called Nordic Way and is a pilot project that seeks to enable vehicles to safely communicate safety hazards through cellular networks on a road corridor through Finland, Norway, Sweden and Denmark. Like Scoop@f, it is linked with the C-ITS platform. The Finnish Transport Agency is involved as well as a number of telecoms and car companies.

Two competing views

In the C-ITS platform itself, car manufacturers and telecoms operators have differing views on the implementation of the new systems. Members of the automotive industry tend to back an extended vehicle solution, with external software and hardware add-ons for some of its features, developed and managed by the automotive manufacturers themselves. The interfaces are designed in such a way so as to not jeopardize security and safety and protect data privacy.

Telecoms operators are broadly in favour of an embedded onboard application platform and a server-based solution that will enable a higher volume of data to be used and thereby enable a higher degree of innovation. Car makers claim that this approach is open to hacking and could jeopardize the safety of drivers.

While disagreements between the two sides remain strong, both have agreed that there is a need to develop the missing standards for an advanced physical/electrical and logical interface which includes the minimum level of security including minimum data sets and standardized data protocols enabling IT services.

IEC leads the way on cyber attacks

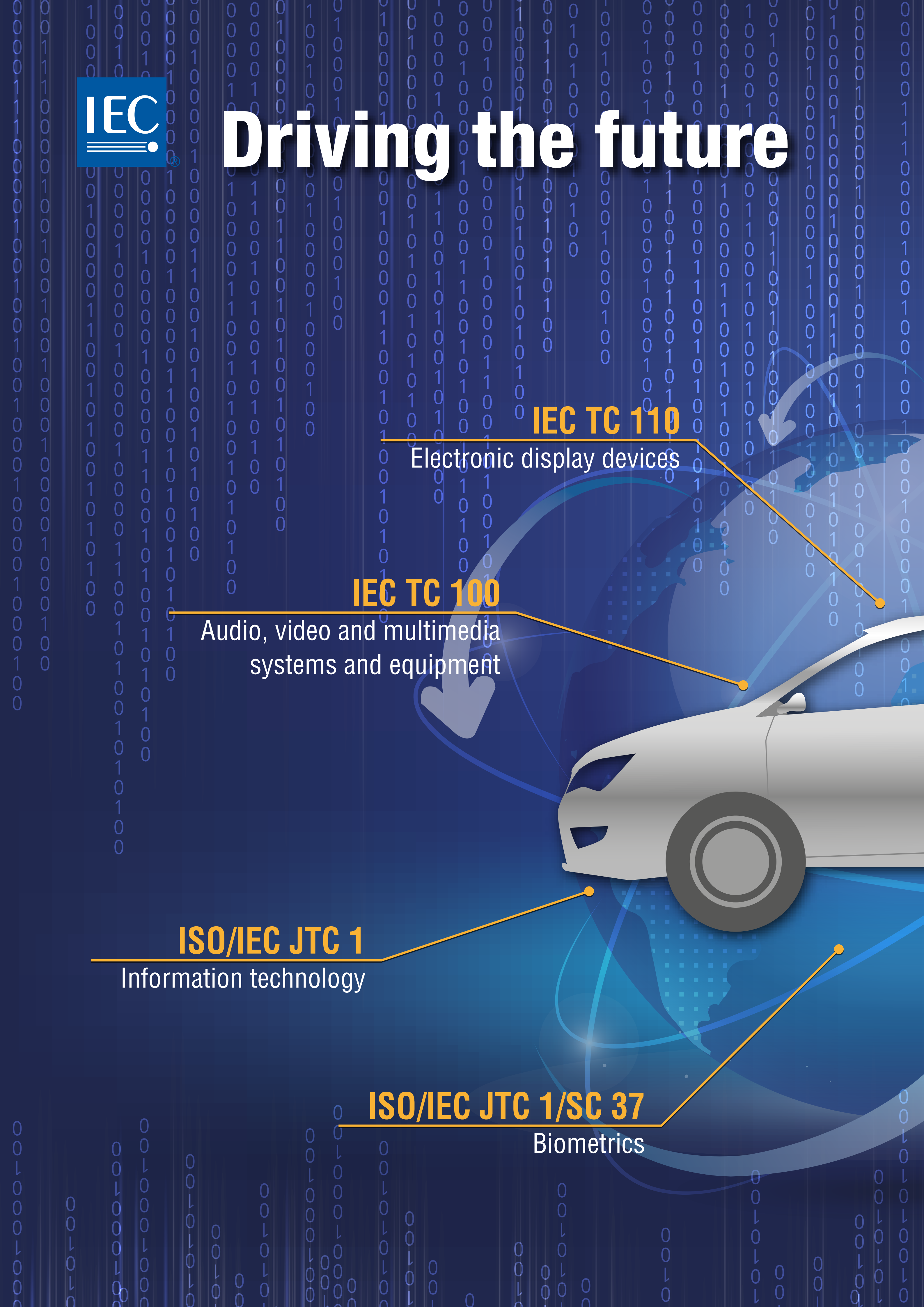
The issue of safety as related to cyber attacks and hacking has long been addressed by the IEC in a wide variety of fields. For instance through IEC 62645:2014 for the safety of nuclear plants, developed specifically to prevent, detect and react to cyber attacks.

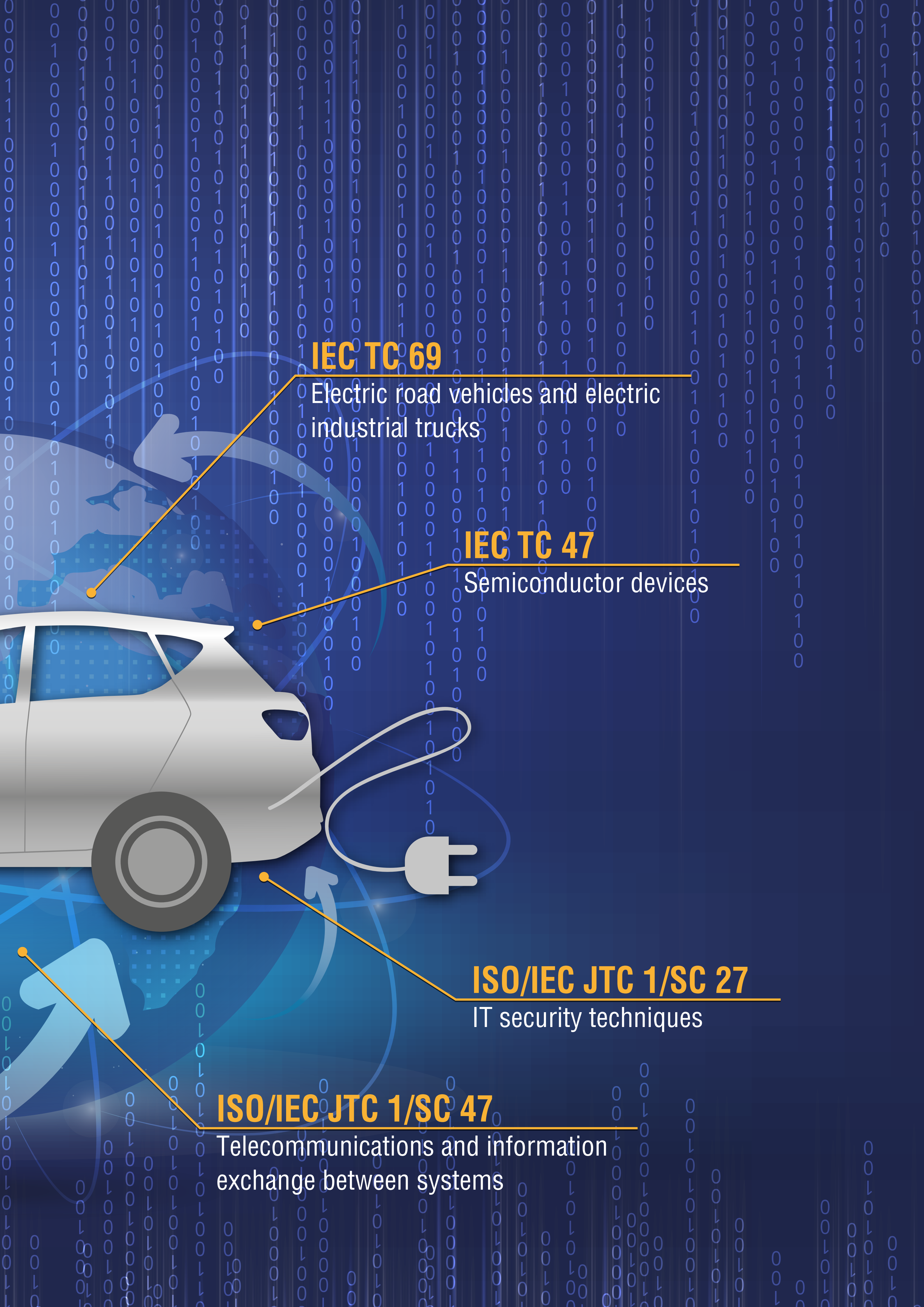
The emerging hacking risks faced by connected and automated cars are being addressed jointly by the IEC and ISO through various Subcommittees (SCs) of their Joint Technical Committee, ISO/IEC JTC 1.

The IEC is also encouraging the adoption of standards, notably in the field of sensor technology, which car manufacturers are already using for autonomous driving. Through IEC TC 47: Semiconductor devices, it produces International Standards for the use and reuse of sensors as well as testing equipment. It also develops Standards in the field of wireless charging for electric and autonomous vehicles, under the supervision of TC 69: Electric road vehicles and industrial trucks.

The IEC System of Conformity Assessment for Electrotechnical Equipment and Components (IECEE), which offers global testing and certification based on International Standards, is also doing essential work in providing all these different products and equipment with the right safety, quality, efficiency and overall performance controls.

Autonomous driving around roadworks (Photo: Nissan)


IEC
Driving the future
IEC TC 110
Electronic display devices
IEC TC 100
Audio, video and multimedia systems and equipment
ISO/IEC JTC 1
Information technology
ISO/IEC JTC 1/SC 37
Biometrics


IEC TC 69
Electric road vehicles and electric industrial trucks
IEC TC 47
Semiconductor devices
ISO/IEC JTC 1/SC 27
IT security techniques
ISO/IEC JTC 1/SC 47
Telecommunications and information exchange between systems

Watching the road ahead

Road transportation and machine vision

By Alan Hodgson, Chair IEC TC 119

Machine vision has a great future in transportation, particularly as we move towards autonomous vehicles. Dealing with standardization in this area will require joint work between different Standards Developing Organizations (SDOs).

Sensors, cameras and automotive

In some sub-systems, sensors have already become a pervasive technology in the modern-day road vehicle. They are now an integral part of engine management, safety systems and climate control. Many of them use MEMS; International Standards for these are prepared by IEC SC 47F: Microelectromechanical systems.

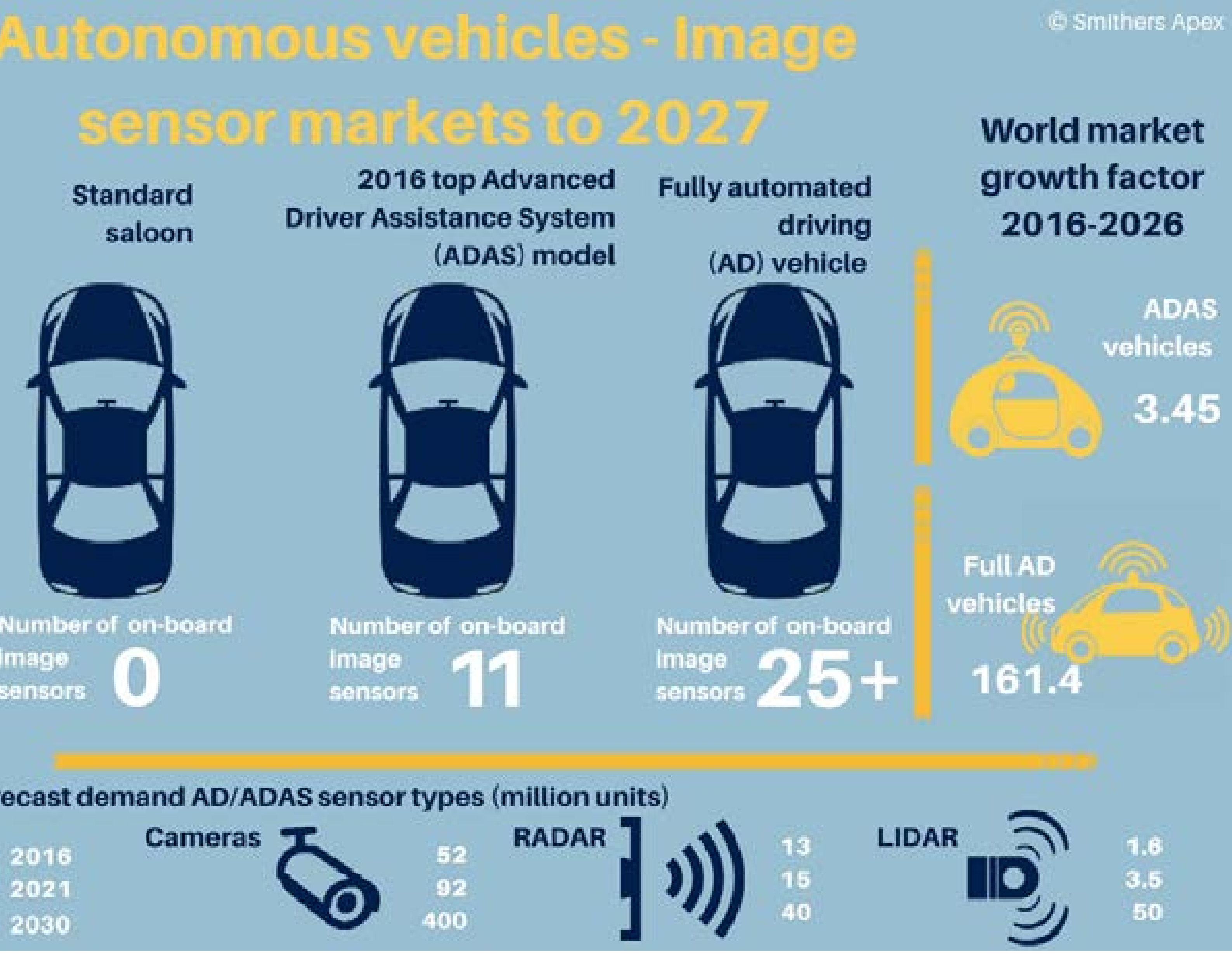
We are now moving into new fields of automotive sensors, based on imaging. We could consider these to be extensions of the proximity sensors currently fitted to automotive products to sense the presence of objects during manoeuvring. As we progress towards the concept of smart traffic, these sensors need to be replaced by full image sensors, making these vehicles machine vision platforms.

Automatic number plate recognition (ANPR) traffic cameras: Inside the housing of a 3M traffic camera (Photo: 3M)

Machine vision in smart transportation

Machine vision applications are not new to transportation. At the most basic level, proximity sensors built into the road detect the presence and transit of a vehicle for traffic tolling. Based on inductive loops and magnetometers, these systems are fine for detecting large iron-based vehicles but rather poorer for sensitivity to modern methods of transportation such as carbon fibre bicycles. Consequently, an alternative solution, designed to enhance the safety of cyclists at junctions and based on thermal imaging, is under test by the cities of Liverpool and Utrecht.

A more recognizable machine vision application is the Automatic Number Plate Recognition (ANPR) approach used in parking areas and mounted above roads. Traffic cameras take an optical image of the car number plate, often at near infrared (IR) wavelengths, and pattern recognize the image to "read" the characters.



Autonomous vehicles - Image sensor markets to 2027 (Infographics: Smithers Apex)

Inward and outward facing image sensors

As we move towards Connected and Autonomous Vehicle (CAV) technology (see article in *e-tech* April 2016), there will be an increasing need for these machine vision systems. In some ways we can consider the image sensors for a smart vehicle to be developing in parallel with those of a smart phone, with cameras facing both the operator and the outside world. In automotive applications, sensors fitted to seats, safety belts and steering wheels are already of interest for monitoring driver fatigue. Image-based sensors may well be positioned to produce the next generation of sensor platforms, looking within vehicles.

Currently it is outward-facing sensors that are attracting the most attention. Advanced Driver Assistance Systems (ADAS) are becoming available, enabling features such as automatic parking, lane-keeping assistance, lane-departure warnings and emergency braking. These features are also obvious requirements for the next generation of smart autonomous vehicles.

Various imaging-based technologies are required to facilitate ADAS. From the vision side, input will come from a mixture of radar, light imaging detection and ranging (LIDAR) and infrared/visible wavelength image sensors. There will also be a substantial software systems need, from mapping technology to critical decision-making systems.

The image sensor space is increasingly well served by academic and industrial conferences. For example, 2017 was the inaugural year for the IS&T Autonomous Vehicles and Machines Conference, sponsored by ON Semiconductor. But what of standardization in this field?

Standards for machine vision in transportation

This is an important area that may well need a central home within standardization. There is also a case to be made for this being across both IEC and the International Organization for Standardization (ISO), as the technology bridges the two areas.

The contribution of IEC TC 69: Electric road vehicles and electric industrial trucks, may be more pertinent longer term, along with ISO/TC 22: Road vehicles, particularly its SC 32:

Autonomous vehicles - Image sensor markets to 2027 (Infographics: Smithers Apex)

Electrical and electronic components and general system aspects. However, none of these would appear to have the background in machine vision that this work requires. A more interesting option for this could be ISO/TC 42: Photography. Formed in 1947 to provide standardization of silver halide-based photographic cameras and materials, it has successfully made the transition into electronic imaging. For example, ISO/TC 42/JWG 20: Digital still cameras, is a Joint Working Group between ISO and IEC groups and this may be a useful model to follow.

Since the establishment of JWG 20 in 1999, this working group, together with others in ISO/TC 42, has provided a gathering place for expertise in the area of electronic imaging standardization. Other ISO/TC 42 JWGs with the IEC include ISO/TC 42/JWG 22: Colour management, which incorporates the work of IEC TC 100: Audio, video and multimedia systems and equipment. The digital imaging technology currently used for machine vision and that will be used for autonomous vehicles relies heavily on image sensors for detecting and conveying the information that constitutes images. International Standards for a multitude of sensors used for imagery, motion and distance detection, such as those used in ADAS and LIDAR, are developed by IEC SC 47E: Discrete semiconductor devices.

Increased coordination between SDOs is a must

Many IEC International Standards are applied or referenced by other SDOs in the automotive industry, such as ISO or the Society of Automotive Engineers (SAE). The ISO 26262, *Road vehicles – Functional safety*, series of Standards, for instance, is the adaptation of IEC 61508, *Functional safety of electrical/electronic/programmable electronic safety-related system*, to the specific requirements of passenger cars and light utility vehicles.

Likewise the SAE J1772-2009 Standard for electrical connectors for electric vehicles, has been added as Type 1 to IEC 62196-2:2016, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – conductive charging of electric vehicles Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories.*

Coordination between various SDOs in the automotive sector is likely to strengthen in the future as the overall share and value of electrical and electronic components in vehicles increases in line with the rollout of increased numbers of autonomous vehicles.

Farming (r)evolution

Agricultural robots bring precision to farms of the future

By Peter Feuilherade

The market for agricultural robots has the opportunity for significant expansion: the farming world needs to increase global production whilst it also faces challenges such as reduced availability and the rising costs of farm labour.

John Deere has unveiled its new project, the first fully-electric tractor SESAM, or Sustainable Energy Supply for Agricultural Machinery, at the Paris International Agribusiness Show in early 2017 (Photo: John Deere)

Many advances in electric self-driving car technology and robotics are transferring across to industrial and commercial vehicles, which account for some 60% of the value of the overall electric vehicle market.

In agriculture, the widening use over the next decade of autonomous hybrid or fully-electric tractors, robotic machinery and drones could increase farm efficiency and revolutionize how food is produced.

Although some of the technology in farming robots is similar to that of autonomous vehicles, it differs in that operations such as planting seeds, picking vegetables or fruits and localized application of pesticides have individual sensing, manipulation and processing requirements.

Factors promoting the take-up of agricultural robotics include the promise of increased productivity and efficiency, falling costs of self-driving technology, reduced availability and rising costs of farm labour and the need to produce more food for a growing global population while crop yields fall in many regions as a result of climate change.

Tractors in transition to electric propulsion

Self-driving kits, allowing tractors with GPS assistance to follow pre-programmed routes on large farms, became available some 20 years ago. Nowadays most high-end tractors are equipped with driverless technology, which is also compatible with combine harvesters. Using GPS, operators can guide tractors and combines to within 30 cm of any plotted location, resulting in more rows in fields and increasing productivity per acre/hectare. More than 300 000 tractors equipped with auto-steer or tractor guidance were sold in 2016, according to market research company IDTechEx.

Leading European and US agricultural machinery companies have launched prototypes of fully autonomous cabless and driverless tractors fitted with GPS-guided steering and sensors including radar, laser and light, imaging, detectionand ranging (LIDAR). The raw sensor data can be used to create an accurate terrain map of both indoor and outdoor environments, while onboard video cameras enhance safety by detecting and avoiding stationary or moving obstacles. Autonomous tractors can also work with other manned machinery.

The standardization work of numerous IEC Technical Committee (TCs) and Subcommittees (SCs) contributes significantly to the performance of cameras and sensing technology used in driverless tractors and other autonomous agricultural machinery. International Standards prepared by IEC TC 47: Semiconductor devices, IEC SC 47E: Discrete semiconductor devices, and IEC SC 47F: Microelectromechanical systems, enable manufacturers to build more reliable and efficient sensors and microelectromechanical systems (MEMS). IEC TC 56: Dependability, covers the reliability of electronic components and equipment.

The technology for driverless agricultural machinery will allow 24-hour autonomous operations such as seeding, planting and tillage to take place. It can enable farmers to address concerns about shortages of agricultural labour, while also increasing productivity and efficiency. IDTechEx notes that delays in the large-scale market introduction of unmanned autonomous tractors are attributable primarily to regulation, high sensor costs and a lack of trust on the part of farmers, not to technical issues.

Tractors are also making the transition to electric propulsion. A prototype fully-electric tractor unveiled by a leading US manufacturer earlier this year is equipped with two independent 150 kW electric motors for a total power output of up to 300 kW (402 hp). It is powered by a 130 kWh battery pack and can run for four hours on a three hour charge.

In the transitional stage to fully-electric tractors, kits are available to transform diesel-engine machines into diesel-electric tractors fitted with generators. In addition, a drivetrain that replaces the transmission, differential and axles with four electric wheel motors provides precise control of the drive tyres.

The range of commercially-available electrically-powered agricultural vehicles extends beyond tractors to self-propelled feed mixers and wheeled loaders, all with zero emissions, minimal noise and smooth driving characteristics.

Several IEC TCs and SCs draw up International Standards for the electronic systems, sensors, motors and batteries used in the driverless technology found in electric-powered autonomous vehicles.

IEC TC 69: Electric road vehicles and electric industrial trucks, prepares Standards for motors and motor controllers, onboard electrical energy storage systems, power supplies and chargers.

Since energy for many smaller agricultural robotic vehicles is often supplied by batteries, TC 69 liaises closely with IEC TC 21: Secondary cells and batteries, and its SCs, which prepare International Standards for all secondary cells and batteries.

The Bonirob agribot uses video- and laser-based positioning (Bosch Deepfield Robotics)

They cover the safety installation principles, performance, dimensions and labelling of the batteries used in electric vehicles. These batteries can be of a number of different technology types including lead-acid, lithium-ion, nickel-metal hydride and lithium iron phosphate.

Although electric tractors require far more power than electric cars, by the time they come into commercial production – in about five years – the size, lasting power and cost of tractor batteries should all have improved.

Diesel-electric hybrid and battery-electric tractors could be available on British farms as early as 2020, according to a February 2017 report by the UK National Farmers' Union. The report envisages that, in the near future, autonomous and traditional machines will be used in partnership with one another, and electric agricultural vehicles – some autonomous, some conventional – will be charged using solar power as well as from mains connections.

Small agribots enable precision farming

While large tractors are efficient on larger farms, small electric-powered mobile robots offer better opportunities for improving productivity on small and medium-sized farms, says Professor Simon Blackmore, Director of the National Centre for Precision Farming (NCPF) and Head of Engineering at Harper Adams University in the UK. "In 20 years, robotics will have revolutionized agriculture", he predicts.

Automatic and robotic vehicles and mobile devices are already used for seeding, planting and tillage, picking and harvesting, weeding, sorting and packaging and even for pruning vines. A few strawberry harvesters are being trialled commercially, while robotic harvesting of apples is in the late stages of prototyping.

These lightweight agricultural robots (agribots) are capable of working day and night and in poor weather. They can also collect and transmit real-time data on the state of fields and crops, find diseases or parasites and spray pesticides.

g as well as satellite navigation to find its way around the fields and with cameras and computer-based image analysis, it recognizes and classifies plants

Typically, agribots are based on some form of robotic tractor implement platform, wheeled or belt-driven, and many are powered by electric batteries, motors and drivetrains.

Depending on the robot's function, onboard sensors may include biological (including chemical and gas analyzers), water, meteorological, soil respiration or moisture, photosynthesis or Leaf Area Index (LAI) sensors, as well as weed detectors, dendrometers and hygrometers. Other components range from cameras and wireless communications to robotic arms, lights for night-time operation and solar panels to recharge batteries.

The rise in the use of robotics, together with the growth of precision agriculture, means that many farming practices will change radically. In precision agriculture, "farm data maps together with GPS-enabled equipment have enabled variable-rate farming technology, allowing farmers to vary the rate of input application based on the needs of specific sites/patches as opposed to the entire farm", according to a 2016 report by IDTechEx.

For example, sensors can detect weeds and other forms of stress, enabling a robot to spray only the area affected by the parasite rather than the entire crop.

Before the end of 2017, a Japanese company in Kyoto prefecture plans to open what it describes as the world's first farm run almost entirely by robots, producing 30 000 heads of lettuce a day. Robots will be involved in every stage of growth from delivering lettuce seedlings, trimming and watering to harvesting and delivering the fully grown produce to the packaging line. The company estimates that using robots will reduce its running costs by around 30%.

In the future, smaller tractors and robots could work together in "swarms" through a cloud-based approach and provide multiple services, ranging from weeding, planting and applying fertilizer to harvesting and packaging food.
The Mobile Agricultural Robot Swarms (MARS) project, sponsored by the European Union (EU), is developing swarms of small, autonomous robots that can seed fields on their own.
The robots are battery-powered with electric-drive mechanisms and are controlled through cloud-based digital technology. The exact placement of each individual seed can be documented and saved in the cloud, with the data used later to carry out cultivation or herbicide application with great precision.

The use of small, mobile agribots also helps to reduce the heavy soil compaction and high-energy consumption usually associated with heavy machinery.

IEC standards support multi-billion dollar industry

IDTechEx reported in September 2016 that agricultural robotics already represent a USD three billion industry, which will grow to USD 12 billion in 2026. "Tractor-pulled robotic implements and autonomous robotic de-weeders will play a substantial part in that growth", the report adds.

Earlier this year, the Dublin-based firm Research and Markets predicted there would be even bigger sales of agricultural robots over the next decade, saying that the global market would grow at a Compound Annual Growth Rate (CAGR) of around 11,9% over the next decade to reach approximately USD 28,6 billion by 2025.

IEC standardization work from many IEC TCs and SCs supports this fast-growing multi-billion dollar industry, with Europe, North America, Australia and New Zealand among the biggest adopters of these technologies.

Kramer launched the first all-wheel-steered fully electric wheel loader in January 2017 (Photo: Kramer)

Smarter than the average lamppost

Connected lampposts offer more than cost savings

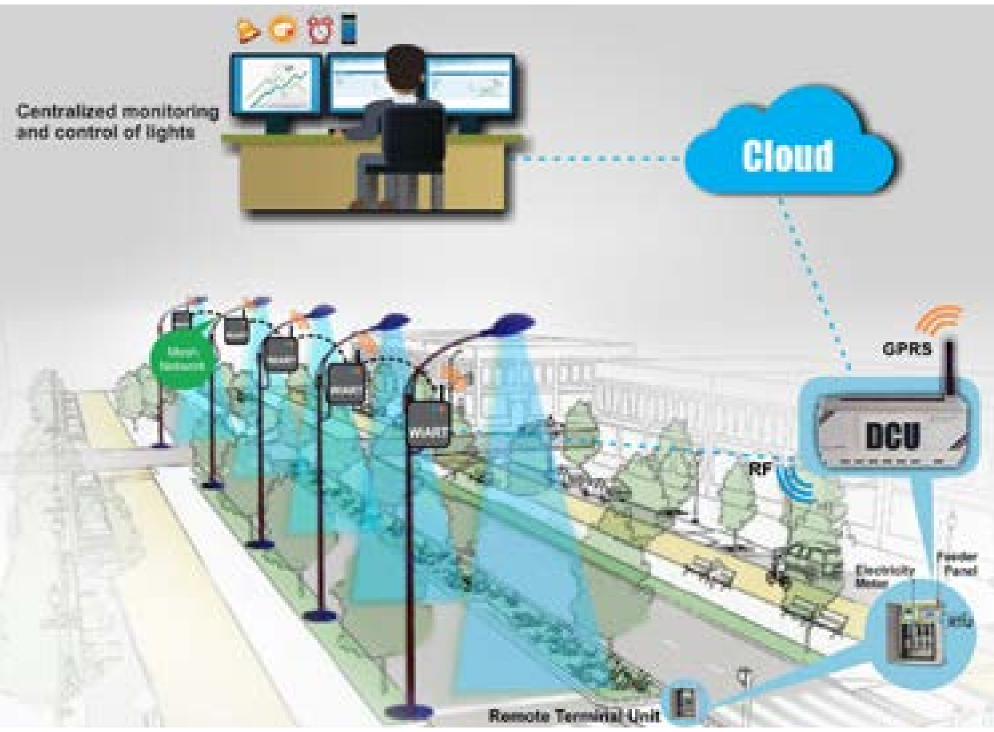
By Antoinette Price

Want a weather update, real-time air pollution status, or are you just trying to find that elusive parking space? It's simple…ask the lamppost!

A planet with millions of lights

As we move towards Smart Cities, technology is being built into buildings, transport and other infrastructure, to make cities function more efficiently. With full access to power and located ideally for communications modules, video surveillance, or information kiosks, it was only a matter of time before lampposts became a part of the Internet of Things (IoT).

Lighting is a vital part of any city. It ensures road safety and increases the personal safety of populations, as people move about the city day and night. Authorities must provide this core public service, which comes at the great cost of purchasing, installing, running and maintaining. However, innovative street lighting management systems are addressing these issues. With integrated connected devices and intuitive web-based applications, they can provide a high level of flexibility to meet the different lighting needs in cities at any time.



Smart street lighting allows operators to control city lighting remotely (Photo: www.iotmag.cz)

The global number of street lights is expected to grow from 304 to 325 million by 2025, according to a report by the Northeast Group. Fortunately, public outdoor lighting is undergoing change and being replaced with light-emitting diode (LED) lighting, which lasts longer, consumes up to 90% less energy compared with other light sources, and reduces maintenance costs.

Standards make smart things smarter

We use smart devices in many daily activities, including communication, buildings, transport, healthcare, shopping, entertainment and banking. A number of IEC Technical Committees

(TCs) and Subcommittees (SCs) produce International Standards, which address different aspects of smart technologies.

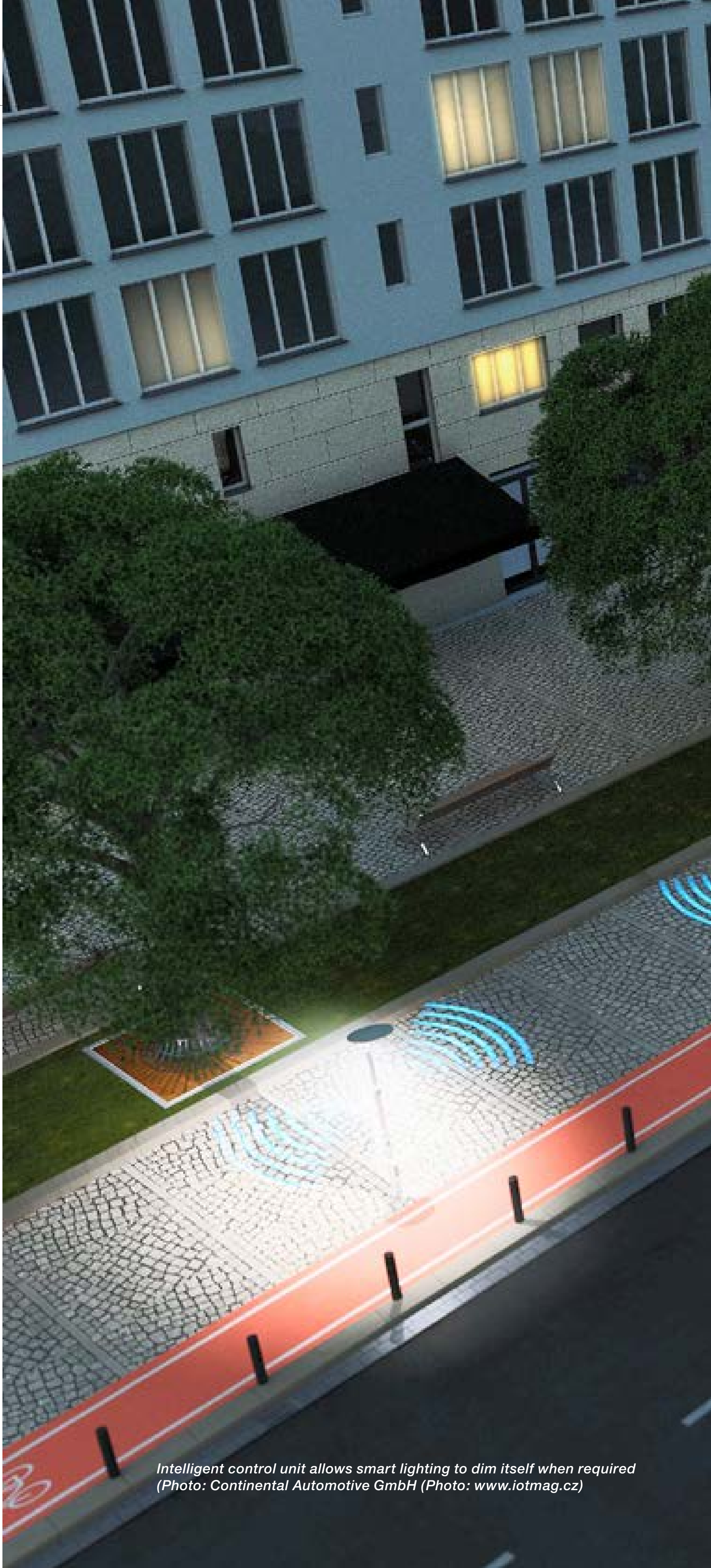
The IoT continues to develop at a pace as more devices become connected. Anything smart relies on information and communications technology (ICT). Linked to this is the need to ensure connected devices and systems are secure and data is protected. This is particularly important for key city infrastructure, such as energy provision, transport and lighting, because breaches or breakdowns could have significant implications for example on public safety.

IEC takes cyber security very seriously and carries out a vast number of standardization activities in this field. For example, ISO/IEC JTC 1/SC 27, a Subcommittee of the Joint Technical Committee set up by the IEC and the International Organization for Standardization (ISO), works specifically on IT methods, techniques and guidelines to address both security and privacy aspects.

ISO/IEC JTC 1/Working Group (WG) 10 is dedicated to the IoT, developing foundational International Standards in this area. It identifies standardization gaps and monitors ongoing IoT regulatory, market, business and technology requirements.

IEC Conformity Assessment Systems test products and services to ensure they conform to IEC International Standards. The Conformity Assessment Board (CAB) WG 17 investigates the market need and timeframe for CA services (global certification schemes) for products, services, personnel and integrated systems in the area of cyber security.

Concerning smart lighting, IEC TC 34 produces International Standards for the reliability, performance and safety of lighting, including LED-based systems used



Intelligent control unit allows smart lighting to dim itself when required (Photo: Continental Automotive GmbH (Photo: www.iotmag.cz)

in smart lighting. The TC covers electric lamps, controlgear, luminaires and more. It also follows the rapid technological developments, which require lighting to be interoperable with other equipment, for example control devices used in smart appliances.

Finally, authorities must make their cities as energy efficient and environmentally friendly as possible, in line with policies and regulations. IEC TC 34 applies IEC Guide 109, which takes environmental issues into account during the development and maintenance of Standards.

Finally, technology sees the light

More companies are offering smart public lighting management systems which give operators a real-time overview of city lighting at any time. This can be viewed using standard web browsers, via an existing mobile network. These web applications analyze the system, facilitate planning and maintenance work.

Since the lights are individually connected to the lighting management system, operators can easily see if they are on and thanks to GPS, identify their exact location. Lighting can be set to automatically dim when no motion is detected, or pre-set for example, to dim a business district that is less populated at night. It also allows light output to be increased during a determined timeframe, such as the run up to Christmas, when people tend to shop more after work. Last-minute changes can be made at the click of a mouse, accommodating the constantly changing needs of cities.

Will LEDs really last as long as they say?

The growing demand for LED technology brings a greater need to ensure that its electronic components, parts and assemblies are of the highest quality and reliability. Consumers expect their initial investment in the more expensive LED lighting to pay off in the long term.

IECQ, the IEC Quality Assessment System for Electronic Components, has developed the IECQ Scheme for LED Lighting, to test and assess the quality of electronic components and assemblies used in the production of LED lamps and drivers against IEC International Standards. This means manufacturers, suppliers and consumers can be confident that the products they sell or buy have been independently verified and meet all requirements and specifications.

From humble light to illuminating assistant

Taking things a step further, networked lampposts can do far more than light the way.

Many cities around the world are already trialling projects, which are adding diverse functions to the once humble provider of light. Like other smart technology, lampposts can communicate with other devices to gather and transmit specific local or more general city information.

They can suggest the quickest travel routes or the most populated ones for those who don't fancy walking alone at night; give pollution updates for a particular street, help drivers locate that elusive free parking place, provide Wi-Fi and events updates or allow electric vehicles to recharge.

Sensors enable smart lighting

None of this would be possible without sensors, which are a key part of the interconnected world of IoT. They monitor ambient light, facilitate touch functions, measure temperature, motion and direction. The work of IEC TC 47: Semiconductor devices, and IEC SC 47F: Microelectromechanical systems, ensures that sensors and microelectromechanical systems (MEMS) work reliably and efficiently wherever they are used.

So how does a lamppost find a free parking space? Again it comes down to sensors, which are placed on the floor of parking spaces to monitor whether they are free or not. Data units collect the information and send it over the mobile network to the city server infrastructure. The information is then conveyed to the lamppost network and displayed on the nearest one, which guides drivers to the free spots.

How bright does the future look?

Many cities are already benefiting from more efficient, less costly smart street lighting. In the report *Smart street lighting* by Navigant Research, global street lighting revenue is expected to be worth USD 2,3 billion by 2023. However, there is a way to go before connected lampposts will become useful street assistants. Still in the early stages, the way these projects deliver this information will decide whether city dwellers adopt this technology on a broad scale.

But the innovations keep coming and the role of lampposts keeps expanding. For example, a private public project in Los Angeles is enabling the funding of networked street lighting, by leasing out wireless technology in the lampposts to wireless providers. As well as improving the city's lighting, it will also enhance the existing wireless network, for which the data demand continues to rise.

IEC International Standards cover many different aspects of smart lighting and the IECQ Scheme for LED Lighting ensures that products and systems meet these Standards.

Lighting the road ahead

International conference presents IEC activities in cyber security

By Morand Fachot

The lighting sector is experiencing a deep transformation across the world as new energy-efficient lighting technologies that first appeared a few years ago gain wide adoption. They are being adopted throughout the world as countries seek to control their energy consumption. IEC Technical Committee (TC) 34: Lamps and related equipment, and its Subcommittees (SCs), develop International Standards for electric light sources including energy-efficient lighting solutions.

Flexible blue OLED panel (Photo GE Lighting)

Cutting energy use, an economic and environmental imperative

Lighting accounts for 15% of global electricity consumption and 5% of worldwide greenhouse gas emissions. At the same time, 1,2 billion people lack access to modern energy services, including reliable lighting, according to the Clean Energy Ministerial (CEM).

An article in the International Partnership for Energy Efficiency Cooperation's *Energy Efficiency Magazine for COP22* claims that "population growth and increased urbanization are expected to cause a 50% rise in lighting demand by 2030."

The article argues that a "global lighting transition to advanced lighting solutions such as light-emitting diodes (LEDs) " would "cut electricity consumption from lighting in half over that same time period." This global transition is the goal of the Global Lighting Challenge (GLC) launched at COP21 in Paris in 2015. At the same time it could avoid 800 million metric tonnes of CO2 emissions a year, equivalent to 684 coal-fired power plants, according to GLC.

IEC TC 34 addressing new lighting challenges

To meet these new lighting challenges, IEC TC 34 and its SCs have changed their structure and developed a large number of International Standards in addition to the continuous development of publications for other types of lighting solutions such as tungsten, halogen or fluorescent lamps.

Due to the introduction of disruptive technology, TC 34 is evolving rapidly

Skate park with LED floodlights (Photo: Osram Lighting Solutions)

to address the following general trends observed today:

- Changes from conventional to LED technology
- Emerging relevance of lighting systems
- Integration of lighting into larger eco-systems and overall control systems
- Pressure to reduce environmental impact linked to energy consumption and materials resources

TC 34 was established in 1948. It has set up four SCs to develop International Standards: SC 34A: Lamps, SC 34B: Lamp caps and holders, SC 34C: Auxiliaries for lamps, and SC 34D: Luminaires. It also has three Working Groups (WGs): WG 5 dealing with "electromagnetic compatibility, electromagnetic fields and power quality…"; WG 6 for photobiological safety, and WG 7 for insulation co-ordination.

The need for interoperability with other equipment and/or installations (e.g. control devices) and rapid technological developments are being increasingly incorporated into IEC TC 34 Standards and other publications, such as Publicly Available Specification (PAS) documents which allow industry-agreed specifications to be developed quickly.

TC 34 estimates that its lighting systems standards may be relevant to the work of an International Organization for Standardization (ISO) TC: ISO/TC 274: Light and lighting.

In addition, an Advisory Group (AG) of TC 34, AG 4: Lighting systems, may recommend collaborating with other organizations and consortia, such as the Institute of Electrical and Electronics Engineers (IEEE), the ZigBee Alliance, Bluetooth, the WiFi Alliance, or Echonet to name only a few. This collaboration is needed to consider normative referencing of their specifications or standards in preparing specific IEC TC 34 lighting systems standards.

Extensive remit – busy agenda ahead

IEC TC 34 also prepares international standards for miscellaneous related equipment not covered by any project of another TC.

As of December 2016, close to 500 publications developed by TC 34 and its SCs were available on the IEC Webstore.

TC 34 and its SCs are suppliers and customers of Standards to a number of IEC TCs and SCs, including TC 20: Electric cables, SC 23B: Plugs, socket-outlets and switches, TC 61: Safety of household and similar electrical appliances, TC 64: Electrical installations and protection against electric shock, TC 76: Optical radiation safety and laser equipment, TC 97: Electrical installations for lighting and beaconing of aerodromes, and SC 121A: Low-voltage switchgear and controlgear.

Given the rapid expansion of the global lighting market and the continuous introduction of new lighting technologies and products, TC 34 and its SCs are set to have a busy agenda ahead for the foreseeable future.

Brave new car world

Our means of transport are changing in drastic ways

By Catherine Bischofberger

What is the future for cars, buses and trucks? Manufacturers are competing to stay relevant in the years ahead. The IEC is also paving the way with a number of forward-looking Standards.

Whether flying, connected, electric, hydrogen-powered or autonomous, the immediate future for cars seems to be spelt out in a few short buzz words which are on everyone's lips. Once you peel away the hype, and take a closer look at technology trends and investment, you realize that big companies have set out clear plans and are pumping large amounts of cash into new technology. Most are planning for these new vehicles to be produced around 2020.

In the future people are expected to own fewer cars, as they increasingly share, rent or use fleet-based autonomous vehicles, particularly in cities. As Volvo Car Group's director for governmental affairs Anders Eugensson admitted, speaking at a joint ITU-UNECE conference on the future of the networked car during the Geneva Motor Show this year: "Owning a car in big cities will become more and more difficult and people will increasingly buy or rent mobility services instead of acquiring physical devices. We see car ownership going down in a decade or so. We are therefore preparing for a future where cars will belong to city fleets and will be renewed, but where fewer people will buy cars".

The Swedish company, which has an unrivalled reputation for building safe cars, has put autonomous driving at the heart of its strategy as it is believed by many to ultimately be safer than man-driven vehicles: no falling asleep at the wheel and no emotional reaction to unpredicted outside stimuli...

Electric and fast!

Tesla has positioned itself as a forward-thinking, visionary outfit with big projects on the way, some of which are expected to be launched in 2017. On the car front they include the much anticipated Model 3 which is to go into production this year after being unveiled as a prototype in 2016 by the company's chief executive officer (CEO) Elon Musk. The car is widely expected to build on the advances achieved by its Model S electric vehicle (EV). The Model 3 will be cheaper than Model S as well as smaller but it is widely expected to be as fast.

Airbus and Italdesign's flying car prototype

Just like Model S, it will be equipped with the company's Autopilot software package, which Tesla claims to have perfected. For Autopilot to work, the car needs to be equipped with ultrasonic sensors placed around the bumpers and sides, a camera, a front radar and digitally-controlled brakes. They combine to allow for the car to take over and stop before crashing occurs.

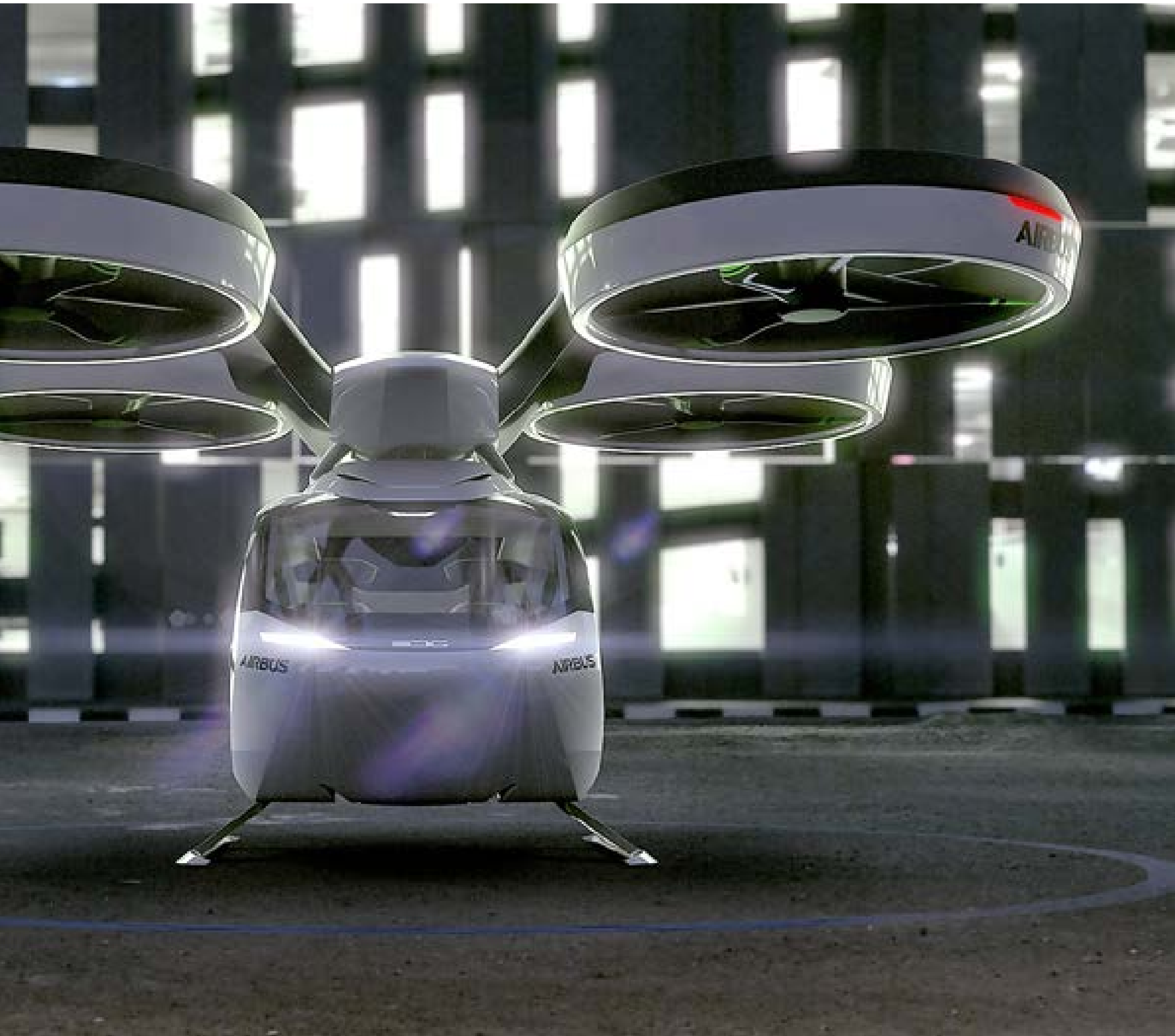
The idea is to enable the car to be semi-autonomous although the driver is still very much in control. Tesla claims to be very close to launching fully-autonomous vehicles as well, which it says should be ready in a couple of years from now. Standards development encouraged by the IEC in the area of EVs is wide-ranging and is overseen by IEC Technical Committee (TC) 69: Electric road vehicles and industrial trucks.

Autonomous and self-driving

Ford has announced that it will produce a fully-autonomous self-driving car without a steering wheel by 2021. The US outfit is increasingly presenting itself as a technology company rather than simply a car manufacturer. Unlike Tesla, Ford is not adopting what it calls "a stepping stone approach."

The IEC is heavily involved in the standardization effort behind sensor technology, an indispensable feature of autonomous driving. Through IEC TC 47: Semiconductor devices, it produces International Standards for the use and reuse of sensors as well as testing equipment.

Daimler-Benz has unveiled plans for a fully self-driving heavy duty truck named Actros. The 430 hp truck has already been driven on a motorway in Southern Germany, after getting



special permission from the local authorities to do so. It was controlled by a system called Highway Pilot, which includes sensors, radars, cameras and active speed regulators. Daimler/Benz showed that the truck could be operated fully autonomously but the aim is for it to assist the driver, rather than replace him.

The company is also developing what it calls a Future Bus, which it has also tested from Amsterdam's Schiphol airport to Haarlem. Based on the same technology as the truck, the Bus used Citypilot, a self-driving package derived from Highway Pilot. The bus is able to communicate with traffic lights and has an auto-brake system that recognizes obstacles. It halts automatically at bus stops and opens and closes its doors.

Arguably, trucks will turn out to be the fastest developing market for autonomous vehicles, as the shortage of drivers in the US represents a huge problem for the transport of goods.

While a number of hurdles still have to be overcome, notably of the legal kind, big plans are afoot.

Europe does not want to be sidelined: the EU has launched the European Truck Platooning Challenge in April 2016. The competition resulted in six different autonomous truck convoys leaving different North European countries and meeting up in Rotterdam.

Smart cars in Smart Cities

Renault-Nissan and architecture firm Foster and Partners shared their vision of a smart car as an energy storing device at last year's Geneva Motor Show. The idea is to transform the car into a sort of electric fuel station. Using Nissan's fully-electric LEAF vehicle as an example, the companies showed how cars could store and distribute renewable energy along a street equipped with an underground Smart Grid. The energy is supplied by a combination of solar, wind and wave sources.

Smart Grids and Smart Cities are at the heart of IEC work. A whole raft of standards has been agreed which address those technologies under the capable remit of IEC TC 57, Power systems management and associated information exchange. The standards involved include IEC 61968, *Common Information Model (CIM)/Distribution Management*, and IEC 61970, *CIM/Energy Management.*

Renewable energy is another key area for the IEC, with a large number of TCs involved, ranging from IEC TC 4: Hydraulic turbines, and IEC TC 82: Solar photovoltaic energy systems, to IEC TC 88: Wind energy generation systems, and IEC TC 114: Marine energy-Wave, tidal and other water current converters, as well as IEC TC 117: Solar thermal electric plants.

One novelty at the 2017 Geneva car show was the Dragonfly concept presented by Swiss company Catecar Group. The car is a depolluting vehicle, with a solar roof developed by

Nissan's smart car concept

EPFL's photovoltaic lab in Neuchâtel. It is equipped with a fine particle filter which cleans the air 24/7. The company is looking for investors and/or automotive companies with which to build joint ventures. "We are talking to several companies in Africa and in Asia," said the company's chairman Henri-Philippe Sambuc.

Is flying the answer?

While Tesla seems to have backed off from its project of creating a flying car, in other parts of the world, plans are afoot to launch hover taxis. Dubai's state transport authority reportedly aims to have these taxis up and running by July of this year, enabling passengers to get around at an altitude of 300 m at speeds of up to 100 km/h. The vehicle used will be the Ehang 184 built by Chinese drone manufacturer Ehang. The autonomous aerial vehicle combines hovering, drone and self-driving technology. It is powered by eight propellers and weighs approximately 200 kg, and will be able to transport one person at a time. A fail safe system will automatically land the vehicle if it senses any component is not functioning properly.

Airbus is another company angling for the head of the pack: at this year's Geneva car show, it wowed visitors with Pop.Up, a concept flying autonomous car, which it developed with Italdesign. It relies on an AI platform which processes all the travel information while the flying module is equipped with eight different rotors.

The IEC, through TC 107: Process management for avionics, is involved in overseeing standards work on electronics used in the aerospace industry but developed in other industries.

Hydrogen versus batteries

Hydrogen fuel cell cars are another key technology in our environmentally conscious world. Just as clean as EVs, the vehicles are powered by pressurising hydrogen with oxygen creating a chemical reaction that generates electricity to power the car. One of the great advantages of the technology is that no time has to be wasted on recharging batteries. The car can just refuel at any petrol station equipped with a hydrogen pump.

Japanese and Korean manufacturers such as Toyota, Hyundai or Honda, are leading the way in this area. So are some big oil companies. Shell is part of a public/private consortium with Total which aims to open up 400 filling stations in Germany by 2023. The Anglo-Dutch company has opened a hydrogen filling station in the UK near Cobham in February this year.

The IEC is paving the way for fuel cell technology. With the help of TC 105: Fuel cell technologies, Standards in that area are being agreed. Most of them fall under the umbrella of the IEC 62282 series of Standards.

From H_2 to electricity and to H_2O – the virtuous circle

Fuel cell technologies offer opportunities to generate cleaner energy

By Morand Fachot

Fuel cells (FCs) convert chemical energy from a fuel into electrical energy and heat through a chemical reaction, and not through combustion. Increasingly they are being introduced in stationary, transportation and portable or mobile power generation applications for different domains. IEC International Standards for FC technologies are proving essential to ensure their smooth rollout in all these areas. They are prepared by IEC Technical Committee (TC) 105.

Different technologies for high efficiency

Fuel cells, like batteries, generate electricity from an electrochemical reaction. Batteries have a self-contained energy supply and must be discarded (primary batteries) or recharged (by an external electricity source) when that supply runs out.

For their part, FCs use external sources of chemical energy, in the form of fuel such as hydrogen or hydrocarbons (natural gas or methanol), from which hydrogen is extracted. As a result FCs can run as long as their supply of fuel (and oxygen) is uninterrupted.

Like primary and secondary batteries that come in different chemistries (e.g. carbon zinc, lead-acid, nickel cadmium, nickel-metal hydride, lithium-ion, etc.) FCs come in varying technology types that use different electrolytes, anodes and cathodes made of diverse materials.

These types include: proton exchange membrane fuel cells (PEMFCs), direct methanol fuel cells (DMFCs), solid oxide fuel cells (SOFCs), alkaline fuel cells (AFCs), molten carbonate fuel cells (MCFCs) and phosphoric acid fuel cells (PAFCs).

Converting chemical energy into electricity and heat using FCs is much more efficient than burning fossil fuels in thermal power plants or in internal combustion engines.

FCs produce heat as a by-product of the electrotechnical reaction (from under 100°C for AFCs and PEMFCs up to around 1 000°C for SOFCs). In FCs operating at high temperatures, process heat can be used in combined heat and power (CHP) and combined cooling and power (CCP) plants. When heat is captured for such cogeneration, the efficiency of FCs can be increased significantly, from around 60% to over 80% in some processes.

Multiple applications

Fuel cell types can vary from tiny devices producing only a few watts of electricity, used to charge or power consumer electronic products, to portable systems like auxiliary power units (APUs) for residential or mobile use or for road vehicles or aircraft (for ground and in-flight power generation), right up to power generation installations.

A fast expanding use of FCs is observed in transportation, mainly to power (or give additional power to) large public transport or industrial electric vehicles (EVs) like buses or forklifts. These EVs often benefit from easy access to hydrogen fuelling installations at their home base.

On the other hand, hydrogen fuelling and infrastructure support for private EVs are not yet widely available in most countries, limiting the adoption of such vehicles.

FCs are increasingly being installed in vehicles as range extenders, in particular for delivery vehicles and hybrid electric buses.

Additionally, all FC technologies have been tested for ship propulsion, with some found to present interesting prospects.

FCs for stationary applications will represent the lion's share of the global value of FC applications in the future, in particular when used in reverse mode to meet power storage and power generation needs (see article in *e-tech, March 2016*). As noted in the article: "FCs for stationary applications should be able to use any locally available fuel".

Using renewable sources to produce the hydrogen needed by FCs by electrolysis that splits water into hydrogen (which can be converted back into electricity in FCs) and oxygen is a perfectly clean solution which generates electricity without any harmful emission and can even provide a storage solution when using reverse mode.

The US Office of Energy Efficiency & Renewable Energy indicates that "electrolyzers can range in size from small, appliance-size equipment that is well-suited for small-scale distributed hydrogen production to large-scale, central production facilities that could be tied directly to renewable or other non-greenhouse gas-emitting forms of electricity production".

IEC TC 105 work to underpin future of FC technologies

The wide range of FC technologies and of their applications dictates a need for common International Standards. These are prepared by

myFC PowerTrekk portable mobile phone charger uses salt and water (Photo: myFC)

Panasonic Ene-Farm home FC for apartments blocks

IEC TC 105: Fuel cell technologies, which first met in 2000.

Its scope is "to prepare international standards regarding FC technologies for all FCs and various associated applications, such as stationary FC power systems, FCs for transportation such as propulsion systems, range extenders, auxiliary power units, portable FC power systems, micro FC power systems, reverse operating FC power systems, and general electrochemical flow systems and processes".

To carry out its tasks, TC 105 set up 14 Working Groups (WGs). It also works in two Joint Working Groups: JWG 16: Cogeneration Combined Heat and Power (CHP), managed by IEC TC 5: Steam turbines, and JWG 7: Flow Battery Systems for Stationary applications, managed by IEC TC 21: Secondary cells and batteries.

Over 70 experts from 11 member organizations are currently active in this TC, which had issued 19 publications as of April 2017 and is preparing many more.

IEC TC 105 refers to Standards developed by more than two dozen IEC TCs, as well as by nine International Organization for Standardization (ISO) TCs, such as ISO/TC 11: Boilers and pressure vessels, ISO/TC 110: Industrial trucks and ISO/TC 197: Hydrogen technologies.

The FC global market is fast expanding, at a compound annual growth rate (CAGR) expected to exceed 24% between 2016 and 2024. It is forecast to reach USD 25,5 billion, with stationary systems making up nearly two thirds of the total, according to a July 2016 Global Market Insights report.

This robust growth points to a heavy workload for IEC TC 105 in coming years.

Ready for the Smart Grid?

The IEC is updating Standards which have wide repercussions on Smart Grids

By Catherine Bischofberger

As the use of Smart Grids escalates around the world, the IEC is busy updating some of its most requested International Standards. Technical Committee (TC) 57: Power systems management and associated information exchange, is working on the IEC 61850 series of Standards.

WG 10 met in Geneva in February

Energy saving

Smart Grids are increasingly used across the world to save energy and because they are more resilient than traditional grids when power fails. The key technologies behind a Smart Grid are sensors that measure the relevant parameters such as temperatures, voltage and current; communications that allow a two-way dialogue with a device; control systems that allow a device to be reconfigured remotely; and user-interface and decision-support systems that provide an overview of asset status and perform advanced analytics on data to provide information.

The IEC 61850 series of Standards deals with communication networks and systems for power utility automation. It has many uses, including for Smart Energy and Smart Grids and is therefore continually being updated and perfected. TC 57 is busy working on these various systems.

The Technical Committee oversees the largest working group inside the IEC, WG 10: Power system IED communication and associated data models, which comprises a massive 250 members.

A little history...

TC 57 was set up in 1964 under the title “Line traps”. It initially started up because there was an urgent need to

With 250 members, TC 57/WG 10 is the largest Working Group in the IEC

produce International Standards in the field of communications between the equipment and systems for the electric power process, including telecontrol and teleprotection. As system aspects gradually became more important, together with the increasing requirement for Smart Grids, the Technical Committee changed its title and scope, and is now TC 57: Power system management and associated information exchange.

It has always been a very active TC, with 166 valid publications to date, including several International Standards but also Technical Specifications and Technical Reports. It currently has 65 active projects in its work programme.

WG 10 was set up in 1995, under the title WG 10: Communication standards for substations: Functional architecture and general requirements. It evolved over time as other working groups were disbanded and their activities transferred to WG 10 which was given its current title, Power system IED communication and associated data models, in 2003.

How to be foolproof

WG 10 has worked – and is still working - on the IEC 61850 series of International Standards, which includes more than 20 different Standards dealing with communication networks and systems for power utility automation.

Part of the challenge is to continue implementing the Smart Grid as an evolution of successive projects spread over several decades. New equipment that has a lower life span than traditional network assets needs to be integrated - three to five years for consumer electronics and telecommunications, compared to more than 40 years for lines, cables, and transformers.

The Smart Grid represents a technical challenge that goes way beyond the simple addition of an IT infrastructure on top of an electrotechnical one. Each device that is connected to a Smart Grid is, at the same time, an electrotechnical device and an intelligent node. Today's "connection" Standards need to address both aspects concurrently.

Meeting in Geneva

Members of WG 10 met at the behest of the IEC in Geneva. Over five days in February, 80 members from countries as varied as Canada, China, Finland, France, Germany, Italy, Japan, Korea, Switzerland and the US, organized into different Task Forces, progressed in writing drafts of Standards, Technical Specifications and Technical Reports related to the IEC 61850 series of Standards.

Convened by Christoph Brunner from it4power with the help of IEC Technical Officer Charles Jacquemart, participants were reminded of the history and work accomplished by TC 57.

Specific presentations were given by other IEC staff members including Alisdair Menzies on the drafting of IEC Standards, Guilaine Fournet on the copyright aspects for code components and Alexandre Bobb on IT strategy.

"The IEC Central Office was keen to organize and host this meeting here in Geneva to show our support for the essential work done by that group," said Charles Jacquemart.

The event was sponsored by ABB, it4power, Helinks, Electrosuisse and Infoteam.

Members of WG10 will next meet in June in the Republic of Korea.

Energy Efficiency starts at home

Manufacturers address energy usage in home appliances

By Antoinette Price

Today, numerous machines and devices powered by electricity can be found in our homes. Take, for example, the kitchen. This room alone probably has a dishwasher, an oven and a fridge, not to mention an array of smaller appliances for preparing and cooking food.

More people need more energy

Many homes also have office equipment, such as computers and printers, and let's not forget entertainment systems, which include television, video, audio and DVD players.

More must be done to ensure everyone has enough energy to meet daily requirements.

As well as increasing energy production by developing renewable energies, many countries around the world have developed policies and regulations to optimize the energy usage of electrical and electronic technologies. As part of this, manufacturers must find ways to improve the energy efficiency of their products.

IEC International Standards are being adopted to facilitate the implementation of these regulations and policies.

A global programme is part of the answer

IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, operates the Electrical Energy Efficiency (E3) programme to support industry efforts to develop energy efficient products.

The programme offers a globally standardized approach to test and verify the Energy Efficiency of electrical equipment and provide proof of compliance to IEC International Standards, which cover energy performance, consumption and level of noise emission.

For example, IEC 62301 contains the method for measuring standby power of household appliances such as computers, entertainment equipment, washing machines, dishwashers, rice cookers and more.

IEC 62087 provides a measuring method for power consumption of TVs, monitors and videos.

Eco programme with energy & water consumption, noise level, off-mode power consumption (Photo: Siemens)

New household appliances are more energy efficient (Photo: racsquality.ca)

Compatible with other major E3 management programmes

The fact that the E3 programme Statement of Test Results and associated Test Reports may be used to assess product Energy Efficiency, means that this programme is compatible with three other major Energy Efficiency management programmes used worldwide, which are:

- Energy rating or labelling (including Minimum Energy Performance Standard)
- Energy efficient product marking or certification
- Standby power reduction programmes

Benefits for businesses, governments and consumers

Since IECEE Members mutually recognize the conformity assessment results for electrical products, the latter can be tested once and accepted in many markets, thereby avoiding lost time while optimizing costs.

The E3 programme also offers proof of compliance with different national regulations. It can be adopted as part of a country's Energy Efficiency programmes, instead of reinventing the wheel, and it contributes to environmental protection.

Find out more about the IECEE E3 programme: www.iecee.org.

Energy efficiency is part of the modern home (Photo: www.abb-conversations.com)

The Ex sector turns to EVs

Ex-proof vehicles are increasingly used in hazardous areas

By Claire Marchand

When the term electric vehicle (EV) comes up, it usually brings to mind electric cars and possibly buses or other means of urban transportation. Seldom do we see the mention of industrial vehicles, although they represent 60% of the global EV market. Even rarer is the mention of Ex-proof industrial EVs, which are increasingly used in hazardous areas, replacing diesel-powered vehicles.

What is a hazardous location?

Hazardous locations are places where fire or explosion hazards may exist due to flammable gases or vapours, flammable liquids, combustible dusts, or easily ignitable fibres or flyings, present in the air in quantities sufficient to produce explosive or ignitable mixtures.
Oil, gas and mining operations are obviously high on the list of hazardous locations but the risk of explosion exists in a variety of other sectors, such as transportation – including aerospace – furniture manufacturing, automotive manufacturing and repair, pharmaceuticals, food processing, grain handling and storage, sugar refineries.

Electric vehicles operating in hazardous environments, such as cranes, have to meet the strictest safety reuqirements (Photo: SIOS BV)

Electrical and non-electrical equipment that must be installed in such classified locations should be specially designed and tested to ensure it does not initiate an explosion, due to arcing contacts or high surface temperature of equipment.

EVs have to be Ex-proof too

Today the use of explosion-proof equipment for hazardous areas is mandatory in most countries around the world and is often included in national or regional – European Union - legislation.

Like any other type of electric vehicles, industrial EVs used in potentially explosive atmospheres – forklifts, tow tractors or cranes, to name but a few – are powered by large-capacity batteries.

Ex environments multiply the risks

Whether off-the-shelf or specially-designed cells, primary or secondary (rechargeable) batteries are all built

Electric vehicles operating in hazardous environments, such as forklifts (Photo: Miretti)

on the same model: one or more electrochemical cells that convert stored chemical energy into electrical energy.

Lead/acid batteries or alkaline (nickel-cadmium, nickel-metal hydride or lithium ion) rechargeable batteries are used in all kinds of small devices, such as computers, smartphones, tablets and cameras. Their large-capacity counterparts are commonly used in transport (EVs, industrial EVs, buses and trucks) and in UPS (uninterruptible power supply) systems.

IEC and IECEx: mitigating risks

While the recharging of batteries, large and small, can be hazardous in itself – hydrogen and oxygen are usually produced inside the battery when charging – the risks are much higher in Ex environments.

This is why, in some cases, the batteries themselves, or the battery pack/box/container have to be designed and build in compliance with the very strict requirements enunciated in standards and specifications, most notably in IEC International Standards developed by IEC Technical Committee (TC) 31: Equipment for explosive atmospheres. This is valid for small-capacity cells as well as for traction batteries (used in EVs).

Battery-operated devices are submitted to the same constraints. Their design and manufacture must be able to withstand the harshest and most extreme environmental conditions. They have to be well insulated and explosion-proof.

Certification needed

Designing and building batteries and containers in compliance with IEC International Standards is not enough. To ensure that any piece of equipment meets the required criteria, it has to be tested and certified. Products associated with a certificate of conformity can be used safely in hazardous environments.

IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres, is the only truly international Conformity Assessment (CA) System that provides testing and certification for all Ex equipment and installations as well as certifies the skills and competence of individuals working in hazardous areas.

Increased level of security

Manufacturers who rely on IECEx for the testing and certifying of their equipment, who have their staff go through the steps necessary to obtain a Certificate of Personnel Competence, have that additional level of security that makes a real difference. They know that they operate in the best possible conditions and minimize the risks inherent to Ex sector.

Access to certificates anytime, anywhere

IECEx has developed mobile applications for iOS, Android tablets and smartphones, that can be found at the Apple App Store and Google Play. They install simplified versions of the main IECEx online Certificate System covering the three Schemes and allow the user to synchronize the Ex mobile apps with the IECEx online Certificate System, as required. The offline mode provides advanced search capability and certificate abstracts (simplified details), while the online version gives the full details of the Certificates.

For more information on IECEx: www.iecex.com

With a little help from ADAS

High-quality sensors key to advanced driving-assistance systems

By Claire Marchand

Advanced driver-assistance systems (ADAS) are developed to automate, adapt and/or enhance vehicle systems for safety and better driving.

ADAS for all

Advanced driving-assistance systems (ADAS) come in many shapes and forms, from adaptive cruise control to collision-avoidance system to lane change assistance and blind spot detection, to name only a few. Some have been around for some time – the GPS was introduced in the 1990s – while others are more recent.

As is the case with many technological advances, in the beginning only premium models were equipped with some ADAS features; today the trend is for automakers to offer at least some form of built-in driving assistance on all cars in a range, for instance parking sensors, cruise control, driver drowsiness detection, automatic braking or intelligent speed detection. Original equipment manufacturers (OEMs) increasingly integrate common sensing technologies for ADAS: video, radar, light detection and ranging (LIDAR), ultrasonic and infrared (IR).

A growing market

According to a report by market research company MArketsandMarkets, the advanced driver assistance system (ADAS)

Many automakers are now offering forward collision alert systems with automatic braking... (Photo: AutoGyaan.com) market is projected to grow at a compound annual growth rate (CAGR) of 10,44% from 2016 to 2021, to reach a market size of USD 42,40 billion by 2021.

James Hodgson, Research Analyst at ABI Research, explains that "vulnerable user detection (VUD) system shipments, including pedestrian, animal, and cyclist detection, will exhibit strong growth over the next decade, with a 49% CAGR."

A quest for safety

The drive behind the development of technological advances in the automotive sector is mainly to increase safety, to help drivers avoid accidents by enhancing their awareness, reaction time and improving the vehicle's response in adverse situations.

There is one common denominator shared by the vast majority of, if not all, advanced driver-assistance systems: sensors. Parking or speed sensors, gyroscopes or radar, camera, infrared, and ultrasonic sensors are only a few in a long list used by the automotive industry today.
But whatever the size or type of the sensor, the device has to be accurate and reliable. Whatever it measures, the measurement has to be extremely precise. A defective sensor can have serious consequences, putting human lives in jeopardy.

Relying on the electronic component supply chain

Sensor manufacturers and suppliers all over the world have a powerful tool at their disposal, enabling their products to meet the strictest requirements: IECQ testing and certification. IECQ is the IEC Quality Assessment System for Electronic Components.

As the worldwide approval and certification system covering the supply of electronic components, assemblies and associated materials and processes, IECQ tests and certifies components using quality assessment specifications based on IEC International Standards.

In addition, there are a multitude of related materials and processes that are covered by the IECQ Schemes.

IECQ certificates are used worldwide as a tool to monitor and control the manufacturing supply chain, thus helping to reduce costs and time to market, and eliminating the need for multiple re-assessments of suppliers.

IECQ operates industry specific Certification Schemes:

- IECQ AP (Approved Process)
  - IECQ AP-CAP (Counterfeit Avoidance Programme)
- IECQ AC (Approved Component)
  - IECQ AC-AQP (Automotive Qualification Programme)
  - IECQ Scheme for LED Lighting
  - IECQ AC-TC (Technology Certification)
- IECQ Avionics
- IECQ HSPM (Hazardous Substances Process Management)
- IECQ ITL (Independent Testing Laboratory)

In summary, safety on the road increasingly depends on ADAS and always on the quality of the sensors used in ADAS.

For more information: www.iecq.org

Vulnerable user detection (VUD) sensors bring additional safety on the road to both pedestrians and drivers (Image: Honda/YouTube)

Growing the IEC next generation

Ongoing opportunities for IEC Young Professionals in IECEE, SMB and CAB groups

By Janice Blondeau

Learn more about how IEC Young Professionals are becoming involved in the technical work of the IEC.

To keep IEC Young Professionals (YPs) engaged in IEC work at national and international level and increase their involvement it's vital that there are ongoing opportunities after the General Meeting and the annual IEC YP workshop. In addition to individual IEC National Committees (NCs) who foster continued YP involvement, IEC Central Office is working closely with the IEC Standardization Management Board (SMB), the IEC Conformity Assessment Board (CAB) (see *e-tech* article *The next generation of IEC leaders* for more details) and IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, to provide opportunities to drive engagement of these up-and-coming leaders and experts.

An inside perspective of IECEE

Since 2016, IECEE has sponsored an IECEE Young Professionals

The IEC Young Professionals – 2017 workshop will be held in Vladivostok, Russia, from 9 to 11 October 2017

This year's winners of the IECEE competition are Siarhei Nazaranka from Belarus...

competition. Winners are invited to attend the IECEE Certification Management Committee (CMC) Meeting, which is to be held this year on 17-18 May, in Yokohama, Japan. There the YPs will benefit from the meeting and the networking opportunities it provides, to help them learn more about conformity assessment, IECEE operations and strategies, and to become more involved with IECEE work.

IEC would like to congratulate this year's IECEE competition winners who are Siarhei Nazaranka, IEC 2016 YP from Belarus, and Dustin Tessier, IEC 2015 YP from Canada. To be eligible, candidates needed to be IEC Young Professionals, which means they had attended one of the IEC YP workshops held during the IEC General Meetings, and their work needed to be related to IECEE activities.

Part of the IECEE family

Last year's winners found their participation in the IECEE CMC in Oslo, Norway, to be very valuable. Here is what they had to say about their experience.

Mauricio Wahast Ávila, IEC 2015 YP from Brazil: "It was a great experience, both for my professional and personal life. I learned a lot about internal and accreditation procedures. What made my participation special was to have information about the Certification Body (CB) Scheme as I am currently working to develop a CB Testing Laboratory (CBTL) application. I felt that the meeting looked like a big family – everybody really knew each other, the environment was inviting and inspired me to be part of it and contribute."

Wong Lu Min (Linda), IEC 2015 YP from Malaysia: "I learnt about the IECEE Basic Rules & Operational documents and proposals for amendment in the pipeline. I also learned about the updated list of IECEE membership and the new applications, which can provide insights for industry. I found the information about collaboration activities with international/ regional organizations valuable – this enables industry perspectives to be considered in regards to new implementation of technical regulations. Also, being a Customer Testing Facility (CTF), I found it interesting to see the comments of the Status of Acceptance on CTF Programmes from Member Bodies and the rationale for the case of non-acceptance."

For more information about this, please contact Robert McLaren (rml@iec.ch)

About the IEC Young Professionals Programme

The IEC Young Professionals Programme was developed as a way for the IEC and its National Committees to reach out to the younger generation of experts, managers and leaders and to encourage their long-term participation in standardization and conformity assessment activities. This helps guarantee continuity in the availability of high quality experts, enabling the IEC to maintain its focus on responding to market needs on a long-term basis.

The IEC Young Professionals – 2017 workshop will be held in Vladivostok, Russia, from 9 to 11 October, in parallel with the IEC 81st General Meeting.

...and Dustin Tessier from Canada

April 2017 nominations and extensions

The latest TC Chair nominations and extensions approved by the SMB

By Amy Bionda

In the month of April, two new Technical Committee (TC) Chairs began their terms, as nominated by the Standardization Management Board (SMB).

Andreas Scholtz, Chair of IEC TC 34 (left) and Benno Weis, Chair of IEC TC 22

Andreas Scholtz

Andreas Scholtz is the new Chair of IEC TC 34: Lamps and related equipment. As the person responsible for the standardization of LED and organic LED (OLED) light sources, lamp caps, lampholders, luminaires and lighting systems at Osram, Scholtz has been actively involved with the IEC, CENELEC and DKE, the German Commission for Electrical, Electronic & Information Technologies of DIN and VDE, since 2005. With over 18 years of work in standardization, Scholtz received the IEC 1906 Award in 2014.

Andreas Scholtz has been voted Chair of IEC TC 34 for the period of 2017-04-01 to 2023-03-31.

Benno Weis

Benno Weis took over as Chair of IEC TC 22: Power electronic systems and equipment, in April of this year.

With a PhD in engineering, and a career spanning over 20 years at Siemens, Weis is currently a Technology and System Expert at Siemens AG. Beyond his involvement with IEC TC 22, Weis has also been active with IEC TC 2: Rotating machinery, and IEC Subcommittee (SC) 77A: EMC - Low frequency phenomena, as well as with other standardization organizations, including CENELEC and DKE.

Benno Weis has been voted Chair of IEC TC 22 for the period of 2017-04-01 to 2023-03-31.

Extensions

The SMB has approved the extension of the term of office of Christoph Oehler, Chair of IEC TC 94: All-or-nothing electrical relays, for the period of 2017-03-01 to 2020-02-28.

We need your creativity!

2017 World Standards Day poster and video contest

By Claire Marchand

The World Standards Day competition is back. In past years, we've had first poster competitions, then video competitions – this year we have both.

Standards make cities smarter

The theme chosen by IEC, ISO and ITU, the three organizations behind the contest, is ***Standards make cities smarter***. We are looking for the most inspired, creative illustration of how International Standards contribute to making cities smarter.

The message delivered by the three organizers, may help you get a grasp of the topic:

"Sufficient fresh water; universal access to cleaner energy; the ability to travel efficiently from one point to another; a sense of safety and security: these are the kinds of promises modern cities must fulfil if they are to stay competitive and provide a decent quality of life to their citizens.

Building a Smart City is highly complex. Every city faces its own challenges and requires its own mix of solutions. However, there is one common denominator that greatly simplifies this task.

International Standards support the development of tailor-made solutions that can be adapted to the particular circumstances of a given city. They contain expert knowledge and best practices, and are essential enablers in ensuring quality and performance of products and services. In addition, they drive compatibility between technologies and help users to compare and choose the best solution available.

Standards also open the door to a larger choice of products and services. They help increase competition and foster innovation. In a systems approach they enable the integration of structures or solutions from different suppliers.

International Standards make things work safely and smoothly together at every level in cities. They provide the foundation for electricity access and all the many devices and systems that use electricity and contain electronics. They support the information and communication technologies that enable data collection, exchange and

analysis, and information security. Last but not least they provide important guidance for all aspects of city life, including energy-efficient buildings, intelligent transportation, improved waste management, building sustainable communities and much, much more.

With Standards, we can make our cities smarter, step by step. Individual islands of smartness can grow together and interconnect. It is comforting to know that International Standards will support smooth and integrated Smart City development."

The competition

Think about how International Standards allow things to work safely and smoothly together at every level in cities – from travel to communication technologies, to waste management and cleaner energy.

The objective is to get you thinking about International Standards, because they often go unnoticed behind the scenes. The winning poster and video will be used to celebrate World Standards Day 2017.

Selection and vote

The three organizers of the competition, IEC, ISO and ITU, will get together and select the top 10 favourite posters and videos based on:

- **Relevance**: does your poster/video clearly illustrate a way in which International Standards help make cities smarter?
- **Understanding**: do you understand the impact of Standards developed by IEC, ISO, ITU on our lives?
- **Creativity and originality**: we are looking for a variety of examples, so you will have more chance if you are not doing the same as everyone else
- **Compliance** with the rules and specifications (details on the WSD competition web page)
- Once the top 10 favourites are selected, they will be put up for vote on social media channels, and then it will be up to the public to decide!

The winners in both categories will be awarded CHF 1 500.

Deadline

The deadline for poster submissions is **5 June 2017** and for videos **14 August 2017.**

Stay up to date!

Follow us on Facebook, Twitter and Instagram

Upcoming global events (April-June 2017)

Two new IEC Standards cover a crucial aspect of secondary batteries: safety

By Claire Marchand

The IEC regularly supports key global and regional industry events, which can present the IEC endorsement on their website and materials.

COLIM 2017 International Conference on Live Maintenance

**Strasbourg, France,
26-28 April, 2017**

Key industry players will discuss new working methods, new procedures and techniques, standards, regulations and legal aspects. Construction, operation, modernization and maintenance experience, safety, economic and strategy aspects and more.

ICS Cyber Security Conference

Singapore, 24-27 April 2017

Cyber security for industrial control systems sector for energy, utility, chemical, transportation, manufacturing, and other industrial and critical infrastructure organizations. On the agenda: protection for SCADA systems, plant control systems, engineering workstations, substation equipment, programmable logic controllers (PLCs), and other field control system devices.

IEC participants benefit from a discount.

Hannover Messe Hydrogen, Fuel Cells and Batteries Exhibition

**Hannover, Germany,
24-28 April 2017**

Key energy storage industry players will discuss latest technologies, hydrogen generation (electrolyzers, reformers), storage and transport, fuel cells, systems and applications (stationary, automotive, mobile, special markets), battery testing and more.

10th Energy Storage World Forum

Berlin, Germany, 8-12 May 2017

Energy providers, utilities and regulators will discuss latest technologies, technical challenges, standards, battery management, business case, regulation, planning & operations, power conversion and more.
IEC participants benefit from a 10% discount.

IDTechEx Show - Emerging technologies unleashed

Berlin, Germany, 10-11 May 2017

3000+ attendees will discover developments and roadmaps for latest technologies, including: 3D printing, EVs, energy harvesting and storage, graphene & 2D materials, IoT apps, printed electronics, sensors and wearables.

IEC participants benefit from a 30% discount.

Digital Utilities Europe 2017

London, UK, 10-11 May 2017

Key industry stakeholders will address challenges of digitization in the utilities sector and examine business cases, financial aspects, technology advances, cyber security and more.

LVDC Conference – Sustainable Electricity Access

Nairobi, Kenya, 22-23 May 2017

Organized by IEC and Kenya Bureau of Standards. Technical experts, government representatives, funding agencies, investors, insurance companies, power utilities, equipment manufacturers and NGOs will learn about what is driving LVDC development, how to safely and broadly roll-out this technology, the role it will play in universal energy access and economic development, use-cases from other countries and more.

CIGRE Symposium Dublin
Dublin, Ireland, 29 May-2 June 2017

On the agenda: system development, operation & control, technical performance, electricity markets & regulation, distribution systems & dispersed generation and more.

More information on the Symposium website

SPARC - FMA International Lighting and Facilities Event 2017
Sydney, Australia, 30 May-1 June 2017

Managers (project, facility, asset, maintenance, operations, purchasing, property) electrical engineers, lighting manufacturers and suppliers and designers will discuss global developments and future directions in facilities and lighting.

Gilles Thonet, IEC Head of ICT Standards Coordination, will participate in the speakers symposium during the event.

IoT Tech Expo Europe 2017
Berlin, Germany, 1-2 June 2017

200+ speakers. 100+ exhibitors. 4,000 attendees. On the agenda: the entire IoT ecosystem including Smart Cities, connected living, developing & IoT technologies, connected industry and data & security.

IEC participants benefit from a 20% reduction using the promo code IEC20.

Grid Analytics Europe 2017
Amsterdam, The Netherlands, 6-7 June 2017

120+ data analytics and domain experts will discuss recent implementations, organizational structuring, cost-effective technology implementation, effective data management, analysis and visualization, use-case expansion, software solutions, R&D and more.

IEC participants benefit from a 10% reduction using the promo code GRID-17-EDSO.

Hydrovision International
Denver, US, 27-30 June 2017

3000+ attendees and 320+ exhibitors will share expertise and learn about the role of hydropower, hydro resources, sustainability, latest technology, challenges and more.

European Solar PV Asset Management
London, UK, 28-29 June 2017

Leading executives and sector experts will discuss: maintenance strategy, best practices, tech innovations, avoiding asset failure, operations & maintenance for utility scale projects, challenges and more.

IEC participants benefit from a 15% reduction.

Safe EV charging

EV charging systems rely on many IEC TC 69 Standards as well as on ISO/IEC 15118 vehicle-to-grid (V2G) communication interface (Siemens AG press photo)

Electric vehicles charging systems rely on IEC International Standards

By Morand Fachot

As electric vehicles (EVs) become more popular in many parts of the world, ensuring that charging systems for these operate safely and reliably is central to wider EV adoption. This rests to a significant extent on IEC International Standards for EV conductive charging systems. A new edition of the general requirements for these has just been published. It is a complete overhaul and much expanded version of the previous edition.

Starting with the basic...

The majority of electric road vehicles, full electric or hybrids, rely on batteries for energy, with the exception of fleets of larger vehicles such as urban transport buses or industrial truck that can use fuel cells. The number of these so-called battery-powered EVs (BEVs) is expected to overtake conventional vehicle powered by internal combustion engines (ICEs) in coming decades.

Charging batteries for BEVs can be done through well-established conductive systems using charging

Efacec fast-charging systems for EVs are installed on stretches of German motorways (Photo: Efacec)


Gefördert durch:
Bundesmin
für Wirtsch
und Techno
aufgrund eines Besch
des Deutschen Bunde
eNterop
» Drive International
Standardisation to enter
V2G Operation on a
broad Basis «

Nissan Leaf EV cables and adapters collection

outlets connecting to the vehicles via special cables, sockets and plugs, or through wireless power transfer (WPT), which is a more recent charging system.

To ensure conductive charging systems are safe and reliable TC 69: Electric road vehicles and electric industrial trucks, which was created in 1969, develops the IEC 61851 series of International Standards for these.

As of April 2017, IEC TC 69 had published five International Standards in this series and is developing nearly 20 more

Third edition of fundamental Standard is a comprehensive overhaul

IEC TC 69 has just published the third edition of IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements.* This edition is greatly expanded on the previous one, published in 2010. This Standard applies to EV supply equipment for charging electric road vehicles, with a rated supply voltage up to 1 000 V AC or up to 1 500 V DC and a rated output voltage up to 1 000 V AC or up to 1 500 V DC. It covers the following aspects:

- characteristics and operating conditions of the EV supply equipment
- specification of the connection between the EV supply equipment and the EV
- requirements for electrical safety for the EV supply equipment

The content of this edition has been re-ordered, the numbering of clauses has changed as new clauses have been introduced and some contents moved for easy reading.

All requirements from IEC 61851-22, which covered AC charging station aspects, have been moved to this Standard, as work on IEC 61851-22 has ceased.

Any requirements that concern electromagnetic compatibility (EMC) have been removed from the text and are expected to be part of the future version of IEC 61851-21-2, *Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply.*

The content of previously existing annexes has been significantly expanded and two new informative annexes have been added. This third edition of the Standard also contains significantly more figures, 42 against 25 in the previous edition.

Full details of the extensive technical changes contained in this Standard compared to the previous edition are available from the relevant page on the IEC webstore.

This third edition of IEC 61851-1 will ensure that general requirements for EV conductive charging systems will be comprehensively covered and help support the growing adoption of BEVs.

In the next issue:

Disaster Relief - Issue 04/2017

Natural disasters strike at regular interval on our planet. As their number seems to be increasing over the years, numerous measures have been taken, at the national, regional or international level, to help prevent them or to mitigate their impact.

Every year has its lot of hurricanes hitting coastal communities, landslides, earthquakes and tsunamis leaving huge areas totally devastated. Many experts point the finger at climate change for the increased intensity of storms, flooding and drought that affect millions of people throughout the world.

Preventive measures are taken on both the domestic and international levels, designed to provide permanent protection from disasters. Not all disasters, particularly natural ones, can be prevented, but the risk of loss of life and injury can be mitigated with good evacuation plans, environmental planning and design standards.

Technological advances also play a major role in the way we apprehend disaster preparedness and relief. And the IEC is a valuable partner in disaster risk prevention and mitigation. IEC standardization and conformity assessment work plays an important role in reducing risk and avoiding major disasters.

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