Continental building blocks for autonomous driving

Automated driving is becoming safe and efficient, according to Elmar Degenhart, Continental chairman, speaking at the 2016 Auto Motor und Sport conference in Stuttgart (31 March to 3 April 2016).

“With the help of intelligently connected technology, automated driving is becoming safe and efficient,” said Degenhart. “Increasing digitisation is changing our products and technologies more and more. This digitisation enables automated driving and prepares the way for new mobility services.”

He said the six building blocks of automated driving were sensor technology, cluster connectivity, human-machine dialogue, system architecture, reliability, and the acceptance of automated driving.

“Our engineers are working on six key building blocks,” he said. “We are developing the components and systems necessary for automated driving worldwide – in the USA as well as in Japan, China and Europe.”

The concept of zero accidents, he said, was no longer a utopia. The basis for this is supplied by advanced driver assistance systems with sensors that record the area around the vehicle at least as well as humans. For sensor fusion, he said, Continental was researching the use of artificial intelligence and bringing its knowledge of sensor technology and electronic control units to the development process.

“In the future, we will also be installing sensors in the tyres, which will enable the car to detect the condition of the road’s surface,” he said. “Tyres will therefore become a key part of our sensor network in the car.”

The company is also working on a backend that will provide accurate traffic information. The basis for this will be the sensor data shared by road users coupled with the traffic backend computer. Future system architectures for automated driving will have to manage securely the huge amount of data that are to be processed in the car.

Under the guidance of Audi, TTTech has developed the ZFas central platform control unit integrating various functions for adas applications. The ECU also enables fusion of sensor data. Microcontrollers from Infineon are used to check requirements for computing performance and safety.

The unit addresses the increasing performance demand of active and passive assistance systems. It enables functions such as piloted driving on congested highways and piloted parking.

A key part of the controller is TTTech’s Deterministic Ethernet, a real-time-capable Ethernet backbone that combines data traffic of different criticality with a high throughput. TTTech’s TTIntegration is used as middleware to run the application functions on top of the networked microcontrollers.

In alignment with Audi, TTTech selected Aurix TC297T microcontrollers from Infineon. The family contains a broad range of microcontrollers including multicore.

“We are delighted to provide our high-performance Aurix microcontrollers as the centrepiece for the future-proof platform ZFas,” said Thomas Boehm, responsible for autonomous driving MCUs at Infineon. The Aurix TC297T microcontrollers with their lockstep architecture and a special safety management unit can host multiple safety-related functions up to Asil D.

Drive like a racing professional

Claimed to be totally different from any existing simulation centre, a motion simulation room in Berkshire, UK, has six professional full motion TL3 simulators, each generating up to 2G of acceleration and offering life-like movement across three axes of heave, pitch and roll.

The venue will offer individuals, groups and corporate guests an opportunity to get behind the wheel of a range of racing cars, in fully professional simulators. Coupled with the world’s first 200° wrap around spherical screen, delivering visuals from a six million pixel image, the driving experience is said to be unbelievably realistic and immersive.

At the press of a button, the driving position can be altered from a Formula One, to a GT or road car. The TL3 simulators, already used by top race teams, have professional race pedals and controls, and full force-back steering.

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Hitachi and Honda integrate alcohol detector in smart key

Hitachi and Honda have developed a prototype portable alcohol detector that can be integrated into a smart key. It can distinguish human breath from other gases.

This device detects the saturated water vapour from human breath and measures alcohol levels within three seconds.

The two companies also developed a system that shows the alcohol level measured by the detector on vehicle display panel. This can become an ignition lock to stop a vehicle from starting when the driver is under the influence of alcohol.

Some systems require drivers to perform the test from the driver’s seat.

Prototype alcohol detector

This device lets drivers measure their alcohol concentration from exhaled breath using three types of semiconductor gas sensors to detect ethanol, hydrogen and metabolised acetaldehyde. This improves accuracy threefold compared with devices only using an ethanol sensor.

The device also measures water vapours from breath with high sensitivity. The sensor consists of an oxide insulator sandwiched between electrodes. Breath is absorbed by the insulator and electric current flows between the electrodes. Sensor area is 5mm square.

To comply with Japan regulations, the device can measure the ethanol concentration from exhaled breath using three types of semiconductor gas sensors to detect ethanol, hydrogen and metabolised acetaldehyde. This improves accuracy threefold compared with devices only using an ethanol sensor.

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Hitachi and Honda plan to commercialise the technology after collecting data from future validation tests.

Omron pleads guilty to Honda Civic bid rigging

Omron Automotive Electronics pleaded guilty and agreed to pay a $4.55m criminal fine for conspiring to rig bids on power window switch installations in Honda Civics sold to US consumers, the US Department of Justice announced.

“Omron and its co-conspirators targeted the Honda Civic, one of the best-selling cars in the United States, to benefit themselves at the expense of Honda Civic owners,” said assistant attorney general Bill Baer of the Justice Department’s antitrust division. “Our investigation will continue to hold accountable companies and executives across the auto parts industry who chose to conspire rather than compete.”

According to the felony charge filed in the USA, Omron, based in Japan, and another manufacturer conspired from 2003 to 2013 to rig bids on power window switches sold to Honda. That conspiracy extended to sales to Honda’s US subsidiaries and affiliates and the switches involved were installed in Honda Civics sold from 2005 to 2013. The plea agreement is subject to court approval.

A statement from Omron said it took this matter seriously and had taken steps to strengthen its training programmes “to ensure compliance with all applicable laws and regulations to prevent the recurrence of such issues in the future”.

Inrix acquires OpenCar

Dynamic connected car services provider Inrix has acquired OpenCar, a US-based automotive software and services provider. The OpenCar purchase extends the Inrix cloud platform into the dashboard with third-party content and applications in a customisable user experience that car makers fully control.

“Today, over half of the connected vehicles in the world use Inrix services,” said Bryan Mistele, CEO of Inrix. “By 2020, more than a quarter billion connected cars will be on the road. With the OpenCar acquisition, Inrix is in the driver’s seat to provide those connected services and expand into the digital dashboard with unique, easy-to-use applications designed especially for next-gen automotive experiences.”

OpenCar, backed for the past five years by a partnership with Mazda, has what is claimed to be the industry’s only white label, standards-based application development environment and framework.

The framework is controlled by the car maker and enables for brand-, model- and region-specific touch and voice interfaces across the entire infotainment.

This capability empowers OEMs to enhance their brand and satisfy consumer demand through in-car information, media and location-based applications. While OpenCar is designed to understand the data generated by advanced vehicle systems, control of how it is used, shared and stored remains in the hands of the car maker.

“We’re excited to see additional competition in this important connected car segment,” said Marcus Keith, head of Audi Connect. “The combination of Inrix and OpenCar should be very compelling for bringing new applications.”

Inrix has also announced the Autoteligennt driver assistance platform. Its cloud-based machine learning enables predictive routing based on where and when drivers go, frequently visited places and preferred routes.

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In embedded system design, reality demands that compromises are made at every phase. Trade-offs between performance, functionality and cost often prevent you from bringing your best ideas to market. We believe there’s a better way. That’s why we’ve architected our latest 8-bit PIC® microcontrollers (MCUs) with flexible, “core-independent” blocks of hardware intelligence that react quickly, consume very little power and are much more cost-efficient than a software-based approach. In essence, Core Independent Peripherals help you easily combine many complex system functions onto a single MCU, increasing speed and flexibility, while reducing power consumption and cost. Design with 8-bit PIC MCUs, and you won’t have to compromise.

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- Minimum latency
- Reduced cost

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**Jaguar introduces remote control car app for Android smart watches**

Jaguar Land Rover has introduced a remote functions app for Android Wear watches. The app has a suite of connected features, including the ability to activate climate control settings by remotely starting the engine.

It also lets customers check their vehicle’s fuel level, monitor its location and remotely lock and unlock the doors to let a friend or family member access the vehicle when the owner isn’t close by.

The app was revealed at last month’s Wearable Technology Show in London as part of a wider demonstration of Jaguar Land Rover’s digital and connected car technologies.

“Showcasing these wearables was Jaguar’s all-new performance crossover, the F-Pace. This supports Android Wear and Apple Watch devices and is the first car featuring the Activity Key. The robust and waterproof wristband is designed for customers who regularly enjoy outdoor activities and allows owners to de-activate the standard key and leave it locked securely in the vehicle rather than carrying it with them.”

This expansion of connectivity brings all the functionality of our Apple Watch app to Android devices and underlines Jaguar Land Rover’s dedication to its connected car vision,” said Leon Hurst, head of connected car product marketing at Jaguar Land Rover.

The company’s InControl Touch Pro infotainment system lets customers access their favourite smartphone apps through the vehicle’s tablet-style 26cm touchscreen. With a quad-core processor and solid-state drive, it runs on ultra-fast Ethernet and supports features such as WiFi hotspot capability, live weather report apps, flight tracking apps and intelligent navigation that can tell friends and colleagues if the owner is running late.

The user-friendly touchscreen interface delivers fast responses and behaves like a mobile device allowing users to pinch and zoom.

The Android Wear watch app will be available on all future Jaguar and Land Rover models as well as on previous models fitted with InControl Remote or InControl Protect.

### US car makers commit to AEB by 2022

The US National Highway Traffic Safety Administration (NHTSA) and the Insurance Institute for Highway Safety have announced a commitment by 20 carmakers representing more than 99 per cent of the US market to make automatic emergency braking standard on virtually all new cars no later than 2022.

The manufacturers making the commitment are Audi, BMW, FCA US LLC, Ford, General Motors, Honda, Hyundai, Jaguar Land Rover, Kia, Maserati, Mazda, Mercedes-Benz, Mitsubishi Motors, Nissan, Porsche, Subaru, Tesla Motors, Toyota, Volkswagen and Volvo Car USA.

AEB systems help prevent crashes or reduce their severity by applying the brakes for the driver. The systems use on-vehicle sensors such as radar, cameras or lasers to detect an imminent crash, warn the driver and apply the brakes if the driver does not take sufficient action quickly enough.

The NHTSA estimates that the agreement will make AEB standard on new cars three years faster than could be achieved through the formal regulatory process.

“It’s an exciting time for vehicle safety,” said transport secretary Anthony Foxx. “By proactively making emergency braking systems standard on their vehicles, these 20 automakers will help prevent thousands of crashes and save lives. It’s a win for safety and a win for consumers.”

### Three phases to autonomous parking

Shipments of new cars with autonomous parking technologies will grow at 35 per cent CAGR between 2016 and 2026 and revenues at 29.5 per cent CAGR, according to ABI Research.

The survey identified three phases of autonomous parking, with each successive stage set gradually to displace the former and all three coexisting to some degree over the next decade. Ultimately, technology will reach a point in which the car parks itself entirely, with no driver assistance or presence within the car required.

In phase one, the car will provide steering assistance with the driver still inside the vehicle and in control. Phase two shows autonomous parking with the driver outside the vehicle but still in control, and phase three introduces autonomous valet parking in which the driver leaves the vehicle at the entrance of a car park. The car then parks itself and waits for the driver to summon it when it’s time to leave.

“Passive assistance from ultrasonic sensors and exterior cameras are becoming standard features in most new car models in developed regions,” said James Hodgson, research analyst at ABI Research. “As more manufacturers turn towards more autonomous parking, OEMs continue to heavily push for consumer education on the systems’ safety benefits and added convenience, to convince them of the value of the concept.”

The American Automobile Association recently published survey results suggesting four out of five US drivers believe their own parking abilities to be adequate. Only a quarter of respondents would trust a self-parking system to replace them in the parking manoeuvre.

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**Ford takes glare out of high beam**

**Ever driven on dipped headlights rather than risk angering other drivers by forgetting the car is using high-beam headlights? Ford has developed a technology that lets drivers take full advantage of their headlights’ capability, without dazzling other drivers.**

Glare-free highbeam uses a windscreen-mounted camera to detect the headlights or taillights of vehicles and bicycles up to 800m away at night, and uses specially developed headlights to block light that could otherwise temporarily blind other drivers and cyclists.

“Ask any driver what the most annoying habits of other drivers are and sooner or later the subject of people who don’t dip their headlights will come up,” said Michael Koherr, research engineer at Ford of Europe. “Ford’s new glare-free highbeam helps maximise the use of high beam and means drivers can see significantly more of the road ahead without causing any distraction to other road users.”

The technology works with Ford’s auto high beam system and dynamic LED headlights with adaptive front lighting, which can adjust the headlight beam angle and intensity to one of seven settings according to speed, ambient light, steering angle, distance to the vehicle in front and windscreen wiper activation.
ETSC calls for updates to vehicle safety mandates

Vehicle safety innovations are still benefitting too few road users in Europe due to an over-reliance on a voluntary testing programme rather than regulatory standards, according to a report by the European Transport Safety Council (ETSC).

For almost twenty years, increases in levels of car safety in Europe have been driven mainly by the voluntary Euro NCAP programme, which awards the safest cars with a five-star rating. But, according to new data, only around half of new vehicles sold in 2013 had been awarded five stars by Euro NCAP during the 2010-13 testing cycle. One popular model, the Dacia Duster, received only three stars and performed particularly poorly in pedestrian safety crash tests.

The authors found marked differences between vehicle brands with Dacia’s poor performance overall being equalled by Land Rover and Jeep during the period covered. Volvo cars, in contrast, outperformed all manufacturers, on average, in every field of vehicle safety including occupant, child and pedestrian protection as well as in safety-assist systems.

Car occupants have also benefitted more than other road users from safety improvements, according to the ETSC, as cars have generally performed worse on pedestrian protection criteria than on adult or child occupant protection. The ETSC is calling for vulnerable road users to benefit from tighter vehicle safety standards through higher minimum standards for pedestrian protection from regulators and from Euro NCAP.

The report also found that green vehicle tax shifts in countries including Denmark and the Netherlands had failed to take account of safety, leading to higher sales of cars with lower safety ratings. The ETSC advises countries to offer tax incentives only to “clean and safe” vehicles. Five-star models in the fuel-efficient supermini class include the Ford Fiesta, Toyota Yaris and all-electric Renault Zoe.

According to the ETSC, the main block to faster progress on safety is that legally mandated safety standards are years out of date. A car that only meets the minimum safety standards in the EU would receive a zero-star rating from Euro NCAP according to the report. Euro NCAP only tests a selection of vehicles each year, and does not test all variants of each model.

“While Europe is still a leader in vehicle safety, this report shows that the benefits are far from being equally spread,” said Antonio Avenoso, ETSC executive director. “We need an overhaul of vehicle safety in the EU to ensure that the latest advances benefit the many not the few. The starting point must be bringing today’s regulatory tests and required standard equipment bang up to date. In the past, it has taken twenty years for technologies such as electronic stability control to be made mandatory. This should not be allowed to happen again with the new generation of life-saving tech such as automated emergency braking, intelligent speed assistance and passenger seat belt reminders.”

Integration moves IMDS data to CAMDS

IoPoint Systems is offering automotive manufacturers an integrated way to collect material data for both IMDS (International Material Data System) and the new Chinese CAMDS (China Automotive Material Data System).

It should let OEMs and suppliers speed up their CAMDS processes.

The system converts and anonymises existing IMDS data sheets in an out-of-box solution without disclosing sensitive data about the supply chain, suppliers and so on to the CAMDS. At the end of 2015, the Chinese authorities changed the information requirements automotive OEMs have to meet when submitting the material data that have to be provided to gain type approval. Manufacturers are now also obliged to collect material data for CAMDS, which has been developed by the China Automotive Technology & Research Center (CATARC) and Chinese OEMs.

To prevent this from doubling the amount of work involved for vehicle manufacturers and suppliers in collecting the necessary material data, IoPoint has created an integrated CAMDS and IMDS that automatically converts IMDS data for use in CAMDS, while protecting confidential business data and relationships.

The company has integrated this into its IoPoint Compliance Agent module and implemented similarily designed user interfaces for IMDS and CAMDS.

Gemalto helps Intest expand telematics in China

Wuhan Intest Electronic Technology is using Gemalto’s Cinterion wireless module to enable 4G LTE connectivity on its T-Box telematics system in China.

The T-Box will let device makers offer fully-connected electric cars so users can enjoy high-speed mobile connectivity for in-car information, emergency roadside assistance and advanced telematics.

Drivers can use their smartphones for a secure keyless entry or ignition, for remote diagnostics, and autonomous parking.

China is expected to overtake the USA as the biggest electric car market, following government’s plan to have five million renewable energy vehicles by 2020. Safety and cost-conscious Chinese are also looking for connected cars that can ease their typical pain points such as car safety and security, roadside emergencies, and traffic congestion.

"Chinese consumers expect a personalised and satisfying customer experience when it comes to car buying," said Mi Feng, CTO at Intest.

“With increasing LTE networks across the country, Gemalto’s module will provide unprecedented data connectivity to local travellers. The Wi-Fi hot spot in the car will allow passengers to simultaneously connect multiple devices to the internet, detect charging stations nearby, and enhance mobility experience.”

Gemalto and Intest’s system should help car manufacturers provide a combination of green vehicles and connectivity for the citizens, driving the popularity of electric cars across the nation.

“Chinese bought nearly 300 per cent more electric cars in 2015 as compared to 2014,” said Sashidhar Thothadri, vice president at Gemalto. “As in-vehicle connectivity expands from luxury models to high-volume midmarket ones, ability to respond fast to consumer preferences will be key to winning the hearts and wallets of people. With award-winning automotive M2M, we can enable Intest to take a lead in helping OEMs deliver innovative, sustainable, with end-to-end security.”
GaN and Pi collaborate on efficient electric vehicles

A collaboration between Pi Innovo’s electronics design and development division and GaN Systems’ gallium nitride semiconductors could provide car makers a pathway to the efficient and effective electrification of auxiliary systems for multi-voltage conventional, hybrid-electric and pure electric vehicles.

GaN Systems’ compound semiconductor devices are said to be cost competitive with silicon devices and have better performance. These gallium nitride devices use low cost GaN-on-silicon base wafers, and have low on-resistance and negligible charge storage.

“Pi Innovo’s hardware, software and applications engineers worked closely with the GaN Systems team to understand their semiconductor design requirements and to ensure the final controller design maximises the reduction in size, weight and power consumption benefits that gallium nitride semiconductors provide,” said Walter Lucking, CEO of Pi Innovo. “Working with GaN Systems on this project has been a great experience for our team and we’re looking forward to continuing our close partnership to support our customers on many future designs.”

Pi Innovo has designed and implemented custom motor control electronics to take advantage of the benefits of GaN semiconductors in applications with input voltages from 12 to 300V. This controller design provides a functional starting-point for the development of 48V and above, high-speed motor-driven vehicle systems.

Pi Innovo is offering design and development services in support of those looking to adopt this technology for a wide range of electronics design applications in automotive markets.

“Having a technology development partner like Pi Innovo that really understands the intricacies of control electronics design for vehicle applications is invaluable in supporting the continued adoption of GaN in the electrification of vehicle systems,” said Jim Witham, GaN Systems’ CEO.

CodeSonar receives ISO 26262 certification

GramaTech’s CodeSonar static analysis software has been certified for use in developing safety-critical software. SGS TÜV Saar deemed CodeSonar 4.1 certifiable according to ISO 26262, IEC 61508 and EN 50128, which define the functional safety of electronics within industrial applications, automotive systems, medical devices and railway applications.

Functional safety standards are becoming more prevalent in international markets, as the use of software in mission-critical and safety-critical applications grows and the need for better safety and security continues to be a pressing issue. Static analysis simplifies the enforcement of coding standards across development teams, improving the overall compliance for a required certification standard while improving the quality of the code.

“The automation and thoroughness that static analysis provides is crucial for supporting safety-critical software development and for ensuring adherence to safety standards,” said Paul Anderson, VP of engineering at GramaTech. “As functional safety standards have become more prevalent, we have continued to add new static checks and additional features into CodeSonar so it can support our customer’s compliance with these standards.”

Panasonic updates tablets for AA patrols

Panasonic is supplying UK recovery breakdown service the Automobile Association with 3000 rugged Panasonic Toughpad tablets to help patrols enhance communications and service to customers. The FZ-G1 tablets will be used by patrols to respond to the 10,000 breakdown calls the AA receives daily on average. The roll-out is underway and scheduled to be completed in early 2016.

Replacing the existing Toughbook CF-19 notebooks, the new tablets will be lighter and easier to use, offer 4G communications and enhanced features such as on-screen forms and signature capture.

“The move to a Panasonic Toughpad tablet was a natural evolution for us,” said Arran Simms, motoring innovations manager at the AA. “With the latest 4G communications and touchscreen capabilities via the Microsoft Windows 8.1 Pro operating system, our patrols will be able to respond faster and more effectively than ever before.”

The tablet is designed to operate outdoors in extreme and remote environments. The FZ-G1 has a 800cd/m² IPS display. The capacitive ten-finger multi-touch display and digitiser pen make it user friendly. It runs on Windows 8 Pro and is equipped with the Intel Core i5-3437U vPro processor.

AA patrols to get updated equipment

AA patrols accept jobs via the tablet, locate the breakdown using GPS and let the customer service centre know when they have arrived on site. They can also search online for specialist knowledge and order replacement parts before completing the task and closing the job.

The AA has also ordered specially designed Panasonic dashboard-mounted vehicle docking stations to hold the tablets when on the move. These let the devices be used for job dispatch and route guidance.

The Panasonic ProServices team of in-house cod designers worked with the AA to refine the existing docking station and produced a system that not only met the requirements of the AA patrol vehicles but also addresses the wider market. The ProServices team tested and installed the docking stations in the vehicles.

“This latest deployment will ensure the AA patrols continue to have access to the very latest ergonomically designed, easy to use and reliable mobile technology on the market,” said Paul Davidson, corporate sales manager at Panasonic. “The enhanced communications features and touchscreen capabilities will ensure drivers in need receive a faster and more efficient service than ever before.”

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Russia sees growth in fleet management

The number of active fleet management systems in commercial vehicle fleets in Russia, CIS and Eastern Europe was 4.2 million at the end of 2015. Growing at a CAGR of 13.5 per cent, this is expected to reach 7.9 million by 2020, according to a report from Berg Insight.

The top-ten providers of fleet management for commercial vehicles across Russia, the CIS and Eastern Europe together have an installed base of more than 2.0 million active units today. Top providers include Curtum, Arvento Mobile Systems, TechnoKom, Mobiliz, Navigator Group, NIS, Scout and Omniconn, all having at least 100,000 active units in the region.

“Eastern Europe is already tracing the most developed European markets closely in terms of system functionality and service models”, said Rickard Andersson, senior analyst, Berg Insight.
Brightening the dash

Tony Armstrong looks at how the latest driver ICs are helping car designers face the challenges of increased use of LEDs
Some of the key applications that drove the explosive growth of LEDs used to backlight thin film transistor (TFT) liquid-crystal displays (LCDs) included high-definition TVs, portable tablet PCs, automotive infotainment displays and the myriad of handheld communication devices. However, to maintain this impressive growth rate LEDs must not only provide enhanced reliability, reduced power consumption and more compact form factors, but must also provide improvements in contrast ratio and colour accuracy.

Furthermore, in automotive, avionic and marine displays, all these improvements must be optimised while simultaneously being subjected to a wide array of ambient lighting conditions from bright sunlight to moonless nights. These TFT-LCD applications include infotainment systems, gauge clusters and a wide array of instrument displays. Of course, backlighting these displays with LEDs creates some unique driver IC design challenges to optimise display readability across a myriad of lighting conditions. This requires LED drivers to offer very wide dimming ratios and high efficiency conversion while also withstanding the rigours of the demanding automotive electrical and physical environment. These must have a very low profile and compact footprints while simultaneously enhancing overall cost effectiveness.

Automotive displays
To support the impressive growth in automotive lighting applications, LEDs must provide a value proposition over their incandescent bulb counterparts. These include ten times more efficient at producing light than incandescent bulbs and almost twice as efficient as fluorescent lamps, including cold cathode fluorescent lamps (CCFLs), thereby reducing the amount of electrical power required to deliver a given amount of light output, measured in lumens per watt.

Many vehicles, such as the Volvo XC90, entertain rear-seat passengers with movies and games

As LEDs are further developed, their efficacy, or ability to produce lumens of light output from an electrical power source, will only continue to rise. Secondly, in this environmentally conscious world, LED lighting does not require the handling, exposure and disposal of the toxic mercury vapour commonly found in CCFL bulbs. Finally, incandescent bulbs are usually required to be replaced after approximately 1000 hours of operation while fluorescent bulbs can last as long as 10,000 hours. However, these figures are dwarfed in comparison to the 100,000 hour plus lifetimes afforded by LED lighting.

In most applications, this extended operating lifetime allows for LEDs to be permanently embedded into the end-application. This is especially important for the backlighting of automotive clusters, instrumentation and infotainment panels, which are often embedded into a vehicle’s dashboard, since they will not require replacement during the working life of the car. Additionally, LEDs are orders of magnitude smaller and more compact than their counterparts so the LCD panels can be made extremely thin, thereby requiring little volumetric space in a vehicle’s interior.

Also, by using a configuration of red, green and blue LEDs, an infinite number of colours can be delivered. Furthermore, LEDs also have the ability to dim and turn on and off much faster than the human eye can detect, enabling significant improvements in backlighting of LCDs while simultaneously allowing dramatic contrast ratios and a higher resolution picture.
strained areas. And all the while, must fit in a very space-constrained area.

Vehicle Electronics

These driver ICs must be capable of operating from the caustic automotive environment. Even when the alternator is attempting a full-charge of an absent battery, surge suppressors on the alternator usually clamp the bus voltage to approximately 36V and absorb the majority of the current surge; however, DC-DC converters downstream of the alternator are subjected to these 36 to 40V transient voltage spikes. These converters are expected to survive and regulate an output voltage during this transient event. There are various alternative protection circuits, usually surge suppressors, which can be implemented externally. However, they add cost and weight, and take up space.

Cold crank is a condition that occurs when a car’s engine is subjected to cold or freezing temperatures for a period of time. The engine oil becomes extremely viscous and requires the starter motor to deliver more torque, which in turn draws more current from the battery. This large current load can pull the battery or primary bus voltage below 4.0V upon ignition, after which it typically returns to a nominal 12V.

An alternative is to use an LED driver that is capable of both surviving and regulating a fixed output voltage throughout both of these conditions. These exist with input voltage ranges of 3 to 30V.
In the second of his four articles, Niroshan Rajadurai asks what is technical debt and where can it be found.

Embedded software is booming and the race is on to develop software faster than ever while maintaining high quality standards, as well as ensuring compliance with industry safety regulations. However, the pressure constantly to churn out new software versions for new models, going back to the drawing board and writing code from scratch simply isn’t viable. Therefore, the software used in cars today already has a varying degree of technical debt.

Technical debt is a metaphor for latent defects introduced during system architecture, system design or system development. First coined by Ward Cunningham in 1992, technical debt refers to the accumulated liability created when organisations take design and test shortcuts to meet short-term goals.

Since the late 1970s, car brands have not only used platform sharing concepts for hardware, but also a proportion of the software for controlling key systems – such as ABS, engine management and infotainment – has evolved from these origins.

Let’s add to the equation the use of code from third-party suppliers, either because of outsourcing for projects that required highly specialised programmers or from buying-in specialised components. As with any integrated system, there are compromises to be made when introducing code from external sources, as there will always be a degree of uncertainty about the quality of the code developed.

Skip forward to today, the automotive industry has seen an unprecedented increase in the integration of new advanced driver assistance systems (adas), such as navigation and vision assisted parking, onto the code base. These features were originally add-on packages, and some were dealer fitted options. Therefore, while designed to function as driver aids to improve safety, they were not considered critical components for the safe operation of the car.

With the advent of connected car concepts that focus on delivering a holistic safe environment for occupants, adas features and their associated software have to be integrated with the safety, engine management, infotainment and other systems via the vehicle bus. All this system integration adds to the system’s complexity and the likelihood of software incompatibilities and, in turn, an increase in the overall technical debt.

The pressure to get to market and cost considerations are part of the reason why so-called legacy code is often used. This pressure brings many trade-offs and short cuts in design, development and testing that have subsequently introduced defects in the software that make its use a high risk behaviour that is not entirely predictable. This technical debt needs to be evaluated as it will affect the
quality of the end product.

The size of the debt needs to be known before it can start to be paid down.

The ideal is to refactor the legacy code; however, to do this an understanding is needed of the functional requirements of the software. Many times this information is no longer available. Therefore, it can be difficult to write a unit test to understand how a particular piece of legacy code works because it often contains embedded dependencies on other components, which are hard or impossible to initialise in a unit testing context.

There needs to be a way to make the scale of the technical debt clearly visible to solve the problem.

Unit and integration testing is essential with any code but when working with legacy code, this type of testing is more complicated.

Rather than looking for an easy way out, software engineers and manufacturers must design and adopt new development processes, which ensure that no new debt is added and existing debt is paid down. There are various ways to do this, but they all require the following steps:

- Understand the problem by capturing key metrics such as code complexity, comment density and API complexity;
- Share the results by publishing the data to all stakeholders; and
- Plan for improvement by focusing effort on the outliers such as splitting functions with the highest complexity.

To continue developing the volume of software that modern cars require, companies must develop scalable development processes that lead to robust and maintainable code bases relatively free of technical debt.

How does one achieve a common understanding of the amount of debt?

The first step is to establish the level of technical debt by gathering metrics and capturing test results that provide insight into the scale of the problem.

To understand these data, companies need to establish a comprehensive and common set of metrics and thresholds for what debt free means and an automated way to capture and report these metrics. This process will establish a where-we-are baseline.

Because software components tend to be developed over time in different locations and by different teams, it is very likely that the baseline metrics will vary dramatically across a code base.

While static analysis can provide some of the debt metrics, it does not measure testing completeness, and as a result does not help determine correctness.

Measuring testing completeness is a key component of understanding the scale of technical debt. Completeness is most easily measured with code coverage analysis, which records the percentage of executable statements and branch outcomes that have been executed by a test case.

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Ford has demonstrated how an autonomous research vehicle can navigate in winter conditions

Driving in snow can be a slippery challenge, with the potential for one blizzard gust to white-out the field of view—a situation faced by many drivers. So if self-driving cars are to become a reality—and they almost certainly will—they must be able to navigate snow-covered roads.

In its quest to bring self-driving vehicles to millions of people around the world, Ford has revealed some facts about how its technology allows for a car to drive itself in snow.

To operate in snow, Ford Fusion Hybrid autonomous vehicles first need to scan the environment to create high-resolution 3D digital maps. By driving the test route in ideal weather, the autonomous vehicle creates highly accurate digital models of the road and surrounding infrastructure using four lidar scanners that generate 2.8 million laser points a second. The resulting map then serves as a baseline that’s used to identify the car’s position when driving in autonomous mode.

Using the lidar sensors to scan the environment in real time, the car can locate itself within the mapped area later, when the road is covered in snow.

The autonomous vehicles can collect and process more mapping data in an hour than the average person uses in mobile-phone data in ten years.

While mapping their environment, the vehicles collect and process a diverse set of data about the road and surrounding landmarks—signs, buildings, trees and other features. All told, the car collects up to 600 Gbyte per hour, which it uses to create a high-resolution 3D map of the landscape. In the USA, the average subscriber of a cellular data plan uses about 21.6 Gbyte per year, for a ten-year total of 216 Gbyte.

The vehicles generate so many laser points from the lidar sensors that some can even bounce off falling snowflakes or raindrops, returning the false impression that there’s an object in the way. Of course, there’s no need to steer around precipitation, so Ford—working with University of Michigan researchers—created an algorithm that recognizes snow and rain, filtering them out of the car’s vision so it can continue along its path.

The way Ford’s autonomous vehicles identify their location is more accurate than GPS. Where current GPS is accurate to about ten metres, autonomous operation requires precise vehicle location. By scanning their environment for landmarks, then comparing that information to the 3D digital maps stored in their databases, Ford’s autonomous vehicles can precisely locate themselves to within a centimetre.

Sensor fusion—the combination of data from multiple sensors—and smart monitoring of sensor health help keep the autonomous vehicles out of the blind.

In addition to lidar sensors, Ford uses cameras and radar to monitor the environment around the vehicle, with the data generated from all of those sensors fused together in a process known as sensor fusion. This process results in robust 360° situational awareness.

Sensor fusion means that one inactive sensor—perhaps caused by ice, snow, grime or debris build-up on a sensor lens—does not necessarily hinder autonomous driving. Still, these autonomous vehicles monitor all lidar, camera and radar systems to identify the deterioration of sensor performance, which helps keep sensors in working order. Eventually, the cars might be able to handle ice and grime build-up themselves through self-cleaning or defogging measures.

The first person behind the wheel of a demonstrated autonomous test in snow was an astrophysics major who never dreamed of it, said Williams. “But it wasn’t until after the test that the achievement began to sink in.”

Ford claims to be the first car maker to demonstrate autonomous vehicle operation in the snow publicly. The company’s winter weather road testing takes place in Michigan, including at MCity—a 32-acre, real-world driving environment at the University of Michigan. Ford’s testing on this full-scale simulated urban campus is aimed at supporting the company’s mission to learn about and advance the emerging field of autonomous driving.

“Because of the extensive development work, we were confident the car would do exactly what we asked of it,” said Williams. “But it wasn’t until after the test that the achievement began to sink in.”

Wayne Williams joined Ford’s autonomy team, he worked on remote sensing technology on behalf of the federal government.

A self-described geek, Williams was intrigued by autonomous vehicles, but never envisioned one day being part of a team working to bring them to reality—let alone being behind the wheel of the auto industry’s first publicly demonstrated autonomous snow test.

The mood in the car that day was all business, he recalls, with a co-worker monitoring the computer system from the back seat.

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ICs tackle Lin communications

Milex has broadened its array of ICs and board level products designed for use in Lin implementations with the MLX 81107 and MLX 81109. These freely-programmable, monolithic devices can address growing demands within the automobile industry for Lin-based switches, actuators, drivers, sensor interfaces and LED lighting systems. They both incorporate a physical layer Lin transceiver, Lin controller, voltage regulator, 16bit risc-based microcontroller, 32kbyte of flash memory and 20-channel analogue-to-digital converter, as well as 16bit pulse width modulation capabilities.

The Lin protocol handler is compliant with Lin 2.0, 2.1 and 2.2, as well as SAE J2602. The ICs have four high-voltage capable (12V direct) IOs, plus eight low-voltage capable (5V) IOs. Through these interfaces, communications with the vehicle’s Lin infrastructure are facilitated. Every IO can be programmed to control the application components using the built-in flash memory. The ICs are supplied in 5 by 5mm QFN packages. Operational temperature range is -40 to +125°C, with over-temperature shutdown and load dump (40V) protection mechanism included.

Automotive Ethernet put to test

An interoperability test platform for Automotive Ethernet is available from Ruetz. The IOP tester constitutes a component of the set-up for Open Alliance layer one interoperability tests for ECUs. It allows the verification of ECUs for interoperability with other ECUs for layer one, based on 100baseT1, OABR.

It has an open application programming interface (API) for integrating into existing test systems. Users can create their own tests and test sequences. Measurements of link-up time, signal quality and cable diagnosis belong within the scope of testing.

The standard test methods for Automotive Ethernet combine the automotive standards with existing reliable and stable systems. Therefore, for component and ECU verification, the compatibility verification process provides the necessary system and is said to simplify the introduction to this technology for car makers and suppliers.

Six alternatives to mech relays

Six intelligent power devices (IPDs) for automotive motor and heater control applications have been introduced by Renevas. They are said to provide a more reliable alternative to mechanical relays that switch the current on and off in ECUs.

An IPD IC integrates in one package control circuits that implement protection and self-diagnostic functions, in addition to power mosfet switching elements. They combine low-loss technology and a cell size of 2μm to achieve an on-resistance of 1.6mΩ typical value when Tch is +25°C. This enables adoption in high current applications.

They operate at up to 100 million switching cycles with no degradation. The guaranteed on-resistance characteristics at a power supply voltage of 3.2V allow the IPDs to be used where starter motor cranking might otherwise be an issue.

The RAJ280002 increases active clamp tolerance from 260mJ to 1700mJ.

IP core provides awareness for radar

A Kalman filter accelerator IP core from EnSilica is for use in situational awareness radar sensors for adas, such as electronic stability control systems, pre-crash impact mitigation, blind spot detection, lane departure detection and self-parking. The core provides an estimated speed improvement over software-only of up to ten times.

Kalman filtering is used in sensor-based adas as part of the radar tracker to smooth out position and velocity measurements obtained from the radar sensors and front-end DSP unit.

The IP core follows the guidelines for integration with devices adhering to ISO 26262. It supports classical Kalman filtering (KF) and extended Kalman filtering (EKF), the latter being applicable when there is a non-linear relationship between the target’s Kalman state and the radar measurements.

The compact, low gate-count architecture of the core enables the computational intensive matrix operations involved in Kalman filtering to be offloaded from the CPU. It operates on range (distance), Doppler (velocity) and azimuth (positional) measurements and applies Kalman filtering to predict the target’s position in the next time interval. It combines the radar measurements with a dynamic motion model for enhancing the target position and velocity estimates with forward prediction, allowing false alarm measurements to be discarded.

The core also provides a generic algorithm framework for fusing measurements from different sensors into a single target track.

For a typical automotive radar system, it can provide a state update computation in about 10µs. This lets a large number of target tracks be maintained at any time, as this level of processing latency is very short compared with a usual radar measurement cycle, which is in the order of a few milliseconds.

The core undertakes five main computational steps – setting the initial values, prediction of the state and error co-variance, computation of the Kalman gain, computation of the estimate, and computation of the error co-variance – using floating point arithmetic to maintain numerical stability and provide identical results to a software implementation. Ram blocks of typically 8kbit, depending on the matrix dimensions, hold the computational matrices.

Supercapacitors use 3V technology

For the regenerative technology market, Vinatex has developed two products using 3V technology. The VEP range suits electric and hybrid vehicles in kinetic energy uses such as braking power and energy harvesting.

The RoHS compliant supercapacitors, with ultra-low ESR, are snap-in types and available in 360F and 500F values using the standard 35 by 62mm can size.

Engineers have re-designed the terminal lay out. Common in large cans are four pins, of which two are for stability, but the VEP uses these pins to attach.

The ESR is almost halved compared with the conventional 3V EDLC series at 2.5mΩ (VEC 4.5mΩ) and power rating is increased to 250A (VEC 200A) with no adverse effects to the leakage current performance.
Development software extends Autosar support

Prevision 7.5, the latest version of the Vector Informatik software, provides users with expanded Autosar support and the ability to develop network communications for commercial vehicles according to SAE J1939.

When designing Can FD networks according to SAE J1939, users will benefit from the simplified model-based electrical and electronic development for commercial vehicles such as lorries, buses and construction and farm machinery. The J1939-based ISO 11783 (Isobus) for lorries, buses and commercial vehicles according to SAE J1939.

The import and export portfolio has been expanded to include Autosar 4.2.1. In addition, communications descriptions for Can FD can be exported in Autosar format. The release also supports the Autosar admin data and SDG concepts.

For processing large data quantities, the release has a reload function that lets users de-select and use the data relevant to them faster and more efficiently. The implemented change history supports collaboration in distributed teams.

With change marking, users can recognise all changes in the model. This enables quick evaluation of work on the data and tracking of the project’s progress.

The efficiency gain results from the consistent and integrated modelling of electrical and electronic systems. This begins with the definition of requirements and continues with the logical architecture level and the hardware and software level including Autosar support and culminates with development of the wiring harness.

Gate drivers score on noise immunity

Claimed to have the highest noise immunity of any gate driver on the market, the Silicon Labs Si2827x Isodriver family are based on digital isolation technology. This common mode transient immunity makes the devices suitable for fast-switching and noisy power supplies.

Applications include power supplies for chargers for electric and hybrid-electric vehicles.

The gate drivers protect power systems by offering immunity to noise transients caused by high-speed switching. Noise immunity is 200kV/μs and latch-up immunity 400kV/μs. This helps prevent modulation loss as well as latch-up, which can be a major safety concern.

There is a choice of single- or dual-isolated drivers with either two independent input controls or a single input for power converter applications. The drivers operate with a 2.5 to 5.5V input VDD and a maximum drive supply voltage of 30V.

Capacitors lower drift

High-voltage MLCCs for automotive use have a rated voltage of 1kV, and include capacitances from 1 to 33nF.

The TDK CGA6 and CGA9 are available with COG and NP0 temperature characteristics. Temperature coefficient is 0±30ppm/˚C maximum and temperature ranges are -55 to +125˚C and -55 to +150˚C, respectively.

As a result, their capacitance drift over temperature is negligible. The capacitors exhibit nearly no drift over voltage and time, making them suitable for applications where high capacitance stability of the components is needed.

Image sensor freezes fast moving scenes

A 0.85cm format, 1.2MP CMOS image sensor from On Semiconductor suits automotive imaging applications. The sensor allows the camera to freeze fast moving scene data, and ensures effective synchronisation with pulsed light sources.

The AR0135 sensor incorporates a global shutter pixel design, with ten times lower dark current and four times higher shutter efficiency than previous generations.

These improvements let the sensor produce clear, low-noise images in low-light and bright scenes, and in high temperature environments. This enables the required eye tracking and gesture detection functions in automotive in-cabin systems.

This 1280 x 960 resolution device is capable of 54 frames per second at full resolution and 720p at 60fps.

Dedicated flash and trigger pins simplify control of external LED light sources and allow easier synchronisation of multiple sensors for stereo camera applications.

The on-chip temperature sensor and statistics engine enhance the diagnostic and control capability of the camera system. It also provides the flexibility of parallel and serial – via a four lane HiSPi interface – outputs.

The AR0135AT is tested and qualified to meet the AEC-Q100 grade two temperature range of -40 to +105˚C, while the AR0135CS supports the standard temperature of -30 to +70˚C. Both come in a BGA-64 package or as bare die. Engineering samples are available, and the devices will be in production in the third quarter of 2016.

SoCs target cost-sensitive safety applications

The first microprocessors in ST Microelectronics’ SPC57 family for automotive applications build on the 32bit Power Architecture SPC5 platform. The devices target cost-sensitive automotive systems that must meet stringent safety requirements, up to ISO 26262 level 2, with ten years support.

The SoCs are devices for entry-level vehicle safety-critical applications, including airbags and anti-lock brakes in cars and motorcycles, power steering, and DC-DC converters and inverters for hybrid and electric vehicles.

They are built using 55nm technology and come in BGA-64 or LQFP-100 pinout functionality and support the required eye clock speed of up to 80MHz. And they are supported by a full-featured tool chain that is compatible with the existing development infrastructure of current Power Architecture devices, enabling rapid development.

The design ecosystem includes the free SPC5 Studio development environment, open-source code and a range of evaluation boards.

The first four members of the family are the SPC570S50E1 (512k flash memory in a QFP64 package), SPC570S50E3 (512k in QFP100), SPC570S40E1 (256k in QFP64) and SPC570S40E3 (256k in QFP100), with the exposed-pad QFP packages supporting increased user pin-out functionality and thermally demanding applications.
Polyamide protects sensitive components from corrosion

For reliable micro-electronics in sensitive automotive applications such as control units and sensors, BASF has developed polyamide 6 and 66 grades that can prevent damage to circuits by electric corrosion. The Ultramid EQ grades are said to be extremely pure, which means they have hardly any electrically active or corrosion-generating contents, yet still resist heat aging.

They are subject to quality tests that cover raw material selection, production process and analysis of the halogen content. There are un-coloured and black grades with glass fibre contents of 30 and 35 per cent.

Electronic assemblies in modern transmission control units or safety-related applications such as airbag and anti-lock systems are becoming ever more compact and complex. They are often exposed to high ambient temperatures and aggressive media such as oil. The delicate circuits are more frequently connected to semiconductors via wire bonding.

In such surroundings, disruptions such as corrosion, ion migration, electrolyte formation and creep currents can cause entire assemblies to fail. Plastics for housings and components have to be equipped in such a way that they do not react with the metals involved and thus prevent electronic failure.

All Ultramid EQ grades have an organic heat stabiliser with halogen content less than 1ppm. This prevents halogens such as iodine or bromine from damaging metal wiring from reacting with the metals, and undesired electric currents from arising.

Switching regulator for EMI emissions

A 3.5A, 65V input capable synchronous stepping switching regulator is available from Linear Technology. The Silent Switcher architecture, with spread spectrum frequency modulation, reduces EMI and EMC emissions by more than 25dB even with switching frequencies above 2MHz, enabling the LT8641 to pass the automotive Cispr 25 class five peak and average limits.

Synchronous rectification delivers efficiency as high as 94 per cent with a switching frequency of 2MHz. Its 3 to 65V input range makes it suitable for single or dual cell automotive and transportation applications.

The internal high-efficiency switches deliver up to 3.5A of continuous output current and peak loads of 5A to voltages as low as 0.81V. The device’s burst mode operation keeps quiescent current below 2.5μA in no load standby conditions, making it suitable for applications such as automotive always-on systems, which need to extend operating battery life.

Minimum dropout voltage is 130mV at 1A under all conditions, suitable for automotive cold crank. A minimum on-time of 35ns enables 2MHz constant frequency switching from a 24V input to a 3.3V output, letting designers optimise efficiency while avoiding critical noise sensitive frequency bands. The 18-lead 3 by 4mm QFN package and high switching frequency keep external inductors and capacitors small.

Internal top and bottom power switches have the necessary boost diode, oscillator, control and logic circuitry integrated into one die. Low ripple burst mode operation maintains efficiency at low output currents while keeping output ripple below 10mV P-P.

Image processor suits Euro NCap 2018

Toshiba Electronics has expanded its line of image recognition processors with a fourth generation device that will help designers implement entry-leveladas applications targeting Euro NCap 2018 camera requirements.

With 13 hardware-based image recognition accelerators, the TMPV 7602XBG incorporates adas features that will become part of the Euro NCap testing programme in 2018.

These include autonomous emergency braking, traffic signal recognition, lane departure warning, lane keeping assist, high beam assistance and forward collision warning. The device also supports applications such as traffic light recognition and night-time pedestrian detection.

Up to five adas applications are processed concurrently within a typical time window of 50ms inside the image recognition processor and with relatively low power consumption due to the purpose-built hardware accelerators and media processing engines.

It integrates CoHOG accelerators that provide high image recognition accuracy especially in low light and nighttime conditions. Colour-based gradient analysis of images supplied by a full HD (2Mpixel) connected camera also improves nighttime pedestrian detection rates.

The processor can handle multiple applications simultaneously in real time using its heterogeneous multi-core architecture. The device has four media processing engines supported by floating point units that perform double precision floating point arithmetic calculations.

The chip is housed in a BGA 521 ball package measuring 17 by 17mm with a ball pitch of 0.65mm.

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