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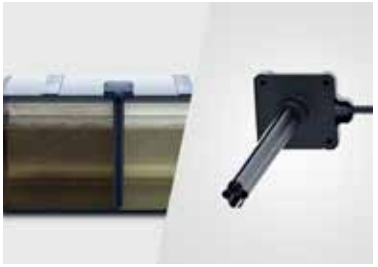

CEO & Editor
Maneesh Prasad
maneesh.prasad@telematicswire.net

Deputy CEO
Anuj Sinha
M: +91 87440 88838
anuj.sinha@telematicswire.net

Director
Lt. Col. M C Verma (Retd.)

Manager- Corporate Communication
Yashi Mittal
M: +91 98103 40678
mgr_corpcomm@telematicswire.net

Corporate Sales Manager
Poonam Mahajan
M: +91 9810341272
mgr_corpsales@telematicswire.net

Editorial Team Member
Richa Tyagi

Web Developer
Neha Nagar

Designer
Bishwajeet Kumar Singh

Publication Address
Telematics Wire Pvt. Ltd.
D-98 2nd Floor, Noida Sec-63
Uttar Pradesh-201301
Email: info@telematicswire.net

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Telematics Wire Pvt. Ltd.
D-98, 2nd Floor, Noida Sec-63
Uttar Pradesh-201301
Email: info@telematicswire.net

With this issue we start a one page section- Take Note Of. We intend to put updates, news and developments from across the world which we think would impact the growth of future automobile in that region. In this July 2020 edition of Telematics Wire, developments covered under this section are- (1) Vehicle scrape policy linked with environment friendly electric vehicle; (2) Academia being involved in the development of autonomous vehicle and AV test beds; (3) Setting up of battery recycling plant; (4) Setting up of EV charging stations & (5) Policy change to enable easy setting up of EV charging stations.

All of these, except development on autonomous vehicle, are in discussion or in implementation in India. Govt of India recently revised guidelines for setting up charging stations. State governments too are following up with specific framework to expedite its implementation in their respective state. Vehicle scrapping policy, which also includes recycling plant, has been in discussions since last October 2019. Though going by the recent statement of Union Minster of Ministry of Road Transport and Highways, it should come through soon. Energy Efficiency Services Ltd. (EESL), a government of India owned public ESCO is actively pursuing setting up of EV charging stations across urban agglomerates.

In terms of thought leadership we match the best in world. Except for our take on self-driving or autonomous vehicle, where government so far had a not so encouraging approach towards it.

Policy under consideration needs to be finalised, as there is associated "cost of an opportunity". The benefit which it could bring to the industry would vary on time scale of implementation. But there is always a tug-of-war between procrastination, which provides immunity from public scrutiny vis-a-vis 'action taken' which is open for all to comment and debate.

Will all these make our automobile industry global market leaders? Can we double our export of auto components and vehicles through incentives in coming five years? Can we be fully electric in automobile production at least, by 2030? Going a level deep, auto makers import nearly quarter of their overall component from China, valued at US$ 4.2 billion.The items imported also includes engine and transmission part, which are significant component in any automobile.

Alternately, if we look at the futuristic automotive, it is going to be dominated by software and applications. Today, it is already about analysing huge amount of data being generated for improved driver safety, vehicle security, traffic management, efficient supply chain and more.

If market value of our home grown automakers are indicative of things to come, we are in for big disruption in coming decade. Tata Motors, Mahindra & Mahindra and Ashok Leyland put together have a market value of about US$15 Billion. Compared to this Ola was itself above US$10 Billion last year and its Ola Electric initiative and recent acquisition of electric scooter- Etergo points to the expanding horizon beyond shared mobility. Today its Ola tomorrow it could be Uber or Didi Chuxing. En passant Ola has ~10% Chinese investment.

MANEESH PRASAD
CEO & EDITOR
TELEMATICS WIRE

EMERGING AUTOMOTIVE TECHNOLOGIES AND PRODUCTS

ANUJ SINHA, YASHI MITTAL
TELEMATICS WIRE

Today Automotive original equipment manufacturers (OEMs) and suppliers face a complex environment unlike anything the industry has experienced before. Innovation is multidirectional and individually each segment or part of vehicle is undergoing innovational transformation. Who could have imagined 'tyre' or 'steering wheel' to become smart and play active role in assisting drivers. To master these changes and successfully operate in new places with new partners, automakers need to rapidly adjust their core. They need to be able to work with new innovative partners in the transforming ecosystems while remaining open to absorbing new technologies and capabilities. Automotive sector over the last few years has emerged as the converging point for emerging technologies, existing products and services. Artificial intelligence and Machine Learning is impacting automakers, vehicle owners, and service providers. Number of companies are using AI/ML for managing the voluminous data being generating through connected vehicle to get meaningful insights into elements which can be monetised. Infotainment panel has started moving into the space which has been dominated by mobile phone for over a decade and half. Making calls, tracking business meeting and appointment schedules, digital payment and entertainment through music is available on the infotainment panel. The public and goods transport will go through paradigm shift with autonomy taking over, in the next decade+ time frame.

In recent months, a growing number of carmakers such as BMW, Ford, General Motors and Daimler, are joining forces with tech startups or bought stakes in companies to press ahead with innovations.

The technologies which will hasten the transition of automotive are many and fast changing. These are elements which will impact the autonomous vehicle, connected vehicle, ADAS (advanced driver assistance system) and vehicle telematics. Some of the emerging technologies which we think would change the automobile in coming decade are:

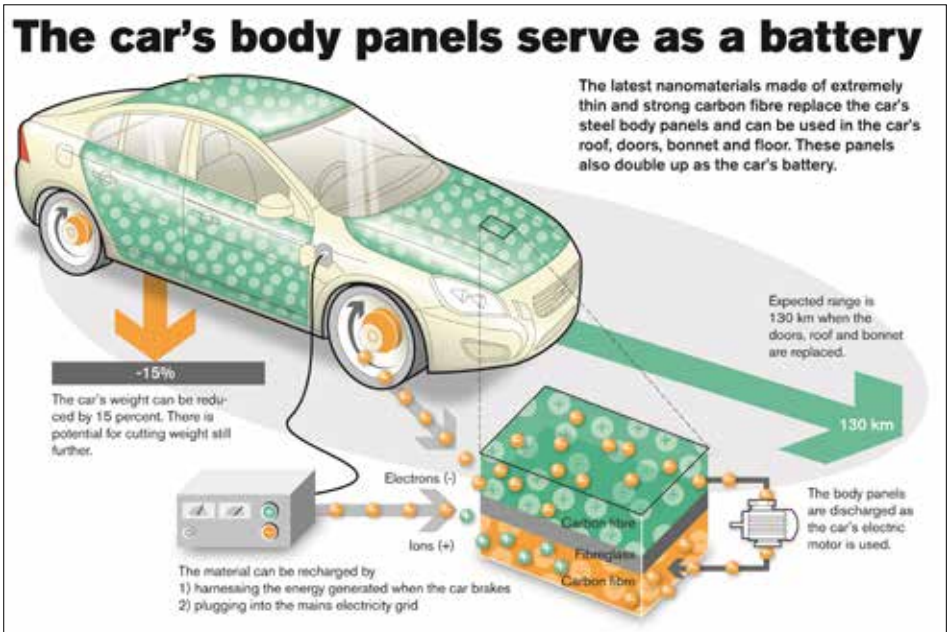
Electric Vehicle Battery

Electric vehicle is going to be the way forward for the automotive and battery will play a key role here. Cost and durability have been two factors which have been talked about in recent past. Going by the developments, we feel three factors are going to be noteworthy:

a. **Longevity-** recent million mile battery- Contemporary Amperex Technology Co. Ltd. (CATL) has developed electric vehicle battery which can last about 16 years and 2 million kilometres (1.24 million miles), according to a Robin Zeng, CEO, CATL.
b. **Solid State Battery-** These batteries use solid electrodes and a solid electrolyte, instead of the liquid or polymer gel electrolytes found in lithium-ion or lithium polymer batteries. There is more power per given weight in these batteries. They are smaller and hence reduce the physical size of device using the battery. They can stay in the field longer and can store harvested energy. Presently Toyota, Dyson, NGK, Solid Power, LG Chem, Samsung SDI, SK Innovation and some of the leading car makers are working on solid state battery which is expected to hit market by 2025.

Battery Infused Body Panel / Energy Storing Body Panels

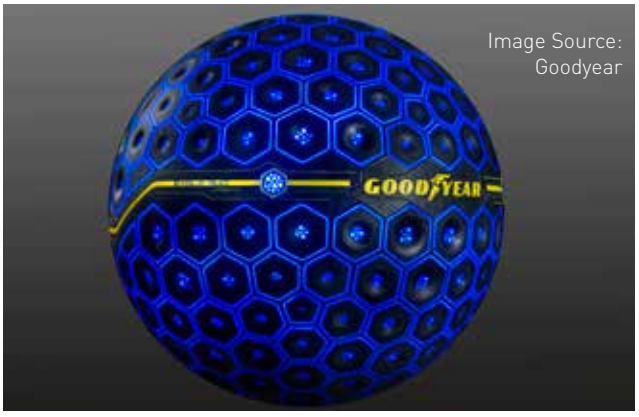
In 2013, EU funded project STORAGE, which had Imperial College, London and Volvo Cars teamed up for an experimental project, which replaced the hood, door panels and trunk lid, with rechargeable carbon fiber panels. Each of the carbon fiber composite panels were infused with flexible super-capacitors capable of harnessing the energy generated through regenerative braking, and discharge back into the electric motor when needed. The composite material also reduced the weight by 60% compared to existing components. While the technical outcome was encouraging, commercialisation will be subject to the cost of carbon fibre, including recycled carbon fibre also which is too expensive, compared to steel or aluminium.



Nano Battery Project — Image Source: VOLVO

Smart Tyres

In 2017, Goodyear showcased its demonstrative tyre, Eagle 360 Urban. The tyres' outer surface is made of elastic polymer(bionic skin), giving it the flexibility much alike human skin, allowing it to expand and contract as per the road surface condition. In case of puncture, the sensor in the tread can locate it and the tyre rotates to change the contact patch. This reduces pressure on the puncture and allows the self-healing process to start. The self-healing works thanks to materials which are specifically designed to be able to flow towards the puncture. They react physically and chemically with each other to form new molecular bonds, closing the puncture.



Goodyear Eagle 360 Urban Wet Tread

Solid State LiDAR

LiDAR are important sensors, playing a critical role in ADAS and autonomous vehicle. Traditionally the LiDAR has been an electromechanical device with motor rotating the light pulse emitter. In contrast solid state LiDAR does not require any moving parts. It is built on silicon chip and is resilient to vibrations. More importantly it costs lesser than electromechanical LiDAR. Leddartech, Robosense, Quanergy, Xenomatix, Texas Instrument, Draper, Aeva and many others are in some stage of solid LiDAR development.

Image Source: Quanergy


Quanergy's S Series is 100% CMOS solid state LiDAR portfolio

Artificial Intelligence & Machine Learning

The transition of automotive into future mobility which will be autonomous and connected, will be powered by AI/ML. There is phenomenal amount of data which is being generated by sensors & ECUs in automobiles, vehicles in connected ecosystem, etc. To get any meaningful insight into these data lakes, companies are using AI/ML which is helping them with improved vehicle maintenance, street map updation through crowd sourced data, traffic data and prediction etc. AI/ML is also a key driver behind the vehicle autonomy. Argo, Otonomo, Waymo are names which

represent different spectrum of the automotive industry using AI/ML.

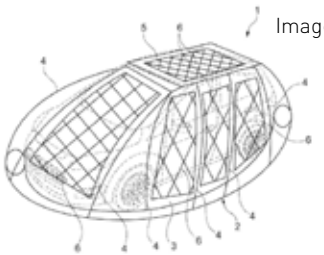
Inflatable Solar Panel Car Cover

A Ford patent application was filed on November 8, 2019, has been published on May 14, 2020, for a roof-mounted device that, with a flip of a switch, covers the entire parked vehicle in a shield of solar panels. It's been more than six years since Ford introduced its C-Max Solar Energi Concept. In 2014, at CES, Ford showed the rooftop solar system that tracks the sun's movement and uses a Fresnel lens to concentrate its energy to charge the C-Max plug-in hybrid. The company claimed the system could produce 8 kilowatts of power.

Automotive companies need to work with new innovative partners in the transforming ecosystems; while remaining open to absorbing new technologies and capabilities.

Big Data & Analytics

Image Source: Electrek



Ford files patent for an inflatable, solar-powered, EV-charging car shield

Big Data Analytics has the potential to deliver competitive advantage to the automotive industry by creating new revenue generation opportunities.

Image Source: ReportBazzar

Nowadays, companies build abilities to leverage big data analytics by quickly generating new insights based on an analysis of structured and unstructured data. Companies are using these insights to design new and innovative products and services which are driven by data to fulfill the business priorities and customer needs. Volvo has adopted data analytics to glean valuable insights through its data sets derived through vibrations, temperature, and pressure sensors in their cars.

The Business model of BMW relies on big data for its core processes starting from design, engineering, support, production, sales along with customer assistance. They use some of the most innovative technologies such as AI, predictive data analytics, that focus on building the future cars which can be driven without any human intervention on the roads.

Volkswagen has produced cars by combining predictive analytics into its sales activities. By using behavioral analytics and prediction analysis, Volkswagen is able to provide their dealerships with increased opportunities for boosting their sales and improving customer retention.With the use of proprietary technologies, thousands of data points are captured through the dealer management systems which are combined with big data comprising of social media profiles, product, consumer lifecycle, financial records, etc. This helps in arriving at the 'Behavior Prediction Score' which is a ranking that helps in revealing the number of customers that are likely to buy to the dealers.

Tesla has been banking on data gathering and data analysis way before its competitors. All Tesla vehicles send data to the cloud. In 2014, through this data gathering, monitoring, and analysis, Tesla was able to detect the problem of overheating of certain engine components and it was able to "automatically repaid" every vehicle using a software patch.

Quantum Computing

While still in an early stage of development quantum computers are already making an impact in the automotive sector, including electric vehicles.

Volkswagen demonstrated use of quantum computing to improve efficiency of traffic routing. In collaboration with Google and D-wave, VW plans to implement quantum computing to reduce traffic congestion. Traffic data is captured with help from smartphones and transmitters inside vehicles. This data is processed in a non-quantum algorithm to decide the traffic density in a given area as well as the number of customers requiring a carrier. This outcome can then be easily processed

Image Source: Volkswagen

Technician is working on a quantum computer from D-Wave

by a quantum algorithm to optimize the number of carriers available versus the number of customers requiring a carrier. Optimization can be done by directing cabs or a public transport service carrier appropriately towards the focus area.

IBM, Daimler researchers use quantum computer to simulate Li-sulfur battery chemistry. Daimler has joined hands with Google to research the application of quantum computing to mobility. ISARA Corporation, the technology facilitator of crypto-agile security and quantum-safe has ensured that the demonstration car of Karma Revero GT which was showcased at CES 2020 can send and receive electronic voice data without any hesitation that the information will be hijacked or gathered – even by a quantum-enabled adversary

Blockchain

The vehicle of the future is expected to be connected, autonomous, shared and electric. Automotive sector started harnessing the power of blockchain in the mid of last decade. Many automakers like Toyota, BMW, Ford, Porsche, Renault, Mercedes-Benz, and so on have started leveraging blockchain technology in areas such as supply chain, security, car service, manufacturing process, insurance, ride sharing, ownership transfer, EV charging, autonomous vehicles, and more. OEMs are also making significant investments in technology startups for the development of blockchain-based solutions.

Two years back Mobility Open Blockchain Initiative (MOBI) consortium was launched in partnership with leading stakeholders from across the entire automotive value chain in May 2018.

In February 2018,Porsche paired with blockchain startup, XAIN, to implement blockchain technology in their vehicles and won the first Porsche Innovation Contest on the subject of blockchain.

In April 2019 BMW Group outlined the new blockchain-based VerifyCar app built with VeChain, which was part of the BMW Startup Garage. In 2019, BMW Group also started the PartChain project to ensure seamless traceability of components using Blockchain.

In February 2017, Daimler AG joined Hyperledger. Hyperledger is a collaborative cross-industry effort which was created to advance blockchain technology. On June 28, 2017, Daimler also announced their first blockchain-based transaction with the major commercial banking company, Landesbank Baden-Württemberg (LBBW).

The Mobility Blockchain Platform at Daimler Mobility AG is aimed at sustainably optimizing booking and invoicing processes for mobility solutions.

In March 2020, Toyota Motor Corporation and Toyota Financial Services Corporation launched Toyota Blockchain Lab.

IOTA and Volkswagen presented their Proof-of-Concept (PoC) for IOTA's new tangle technology at the CEBIT 2018 Expo in Germany.Tangle is a blockchain developed by IOTA that allows for updates to be applied to various technological devices

Image Source: Disruptor Daily

in near real time. Volkswagen aimed at utilising IOTA's tangle system to update their autonomous vehicles and provide information about the Volkswagen car to drivers. In April 2019, Volkswagen announced a partnership with blockchain company Minespider with a vision to improve battery supply chain with blockchain technology. From mine to factory, Volkswagen claims to make the supply chain transparent with blockchain.

In February 2019, Mercedes-Benz developed a prototype program which allows a transparent mapping and understanding of this transmission across the entire supply chain. The company announced its partnership with Icertis,

In January 2020, Mercedes-Benz Cars has set itself a high goal of launching a carbon neutral new passenger car fleet in less than 20 years with its pilot project,"Ambition2039". It requires detailed knowledge of all climate relevant processes associated with the entire vehicle value chain. In order to achieve this, Mercedes-Benz is creating transparency of CO_2 emissions and the use of secondary material in the supply chain. In relation to

Growing number of carmakers such as BMW, Ford, General Motors and Daimler are joining forces with tech startups or bought stakes in companies to press ahead with innovations.

this as part of STARTUP AUTOBAHN, Mercedes-Benz has also started a pilot project with a key battery cell manufacturer and Circulor, a start-up in blockchain technology.

Groupe Renault has been using blockchain technology since 2015 and considers the blockchain as a vector for the transformation of the automotive industry. The company claims that some twenty projects to deploy this technology have been identified. Their focus is traceability of financial transactions and communication with equipment manufacturers and the sales network which will hopefully be deployed very soon.

In July 2017, Groupe Renault announced a prototype for a digital car maintenance book leveraging blockchain technology. Renault partnered with Blockchain leaders like Microsoft and VISEO to store its car's passport information in a secure and transparent manner on the blockchain-based data storage system.

Human- Machine Interface

Nowadays the vehicles are inclined towards smartphone centric infotainment systems which have boosted the popularity of multimodal in-car interfaces.

Today, vehicles are connecting with software products and services, and the design of HMI

is becoming increasingly driver-focused with features like UX/UI solutions that shorten driver response time, improved interaction between human-vehicle, and deliver better user experience supplemented with mobile features which is already in use by the drivers. Some of the HMI trends are- Screens/Display, Voice Commands, Haptic Touch, Drive by Wire, Virtual Assistants, Taking Control, Being Connected

HMI solutions which are becoming commonly available are:

- Heads Up Display (HUD) is one of the most popular HMI solutions. In HUD, the information is displayed directly in front of the driver onto the windshield.
- Rear Seat Smart Entertainment system – Connect your phone and operate directly from the touch screen, watch movies and listen to music through the multimedia inputs.
- Voice recognition and voice guidance - Providing cloud-based voice recognition services
- Integrated web & mobile navigation - Building applications that integrate web and mobile navigation systems
- UX/UI design & usability research
- Realistic & high-performance 3D rendering

3D Gesture Technology

Automotive manufacturers are offering a plethora of infotainment and other electronic features to enhance the user experience. However, it is known that controlling multiple devices and functionality features will distract drivers. This is where 3D gesture technology comes into picture as it will allow users to control many elements of their vehicle with mere gestures. The vision is to prevent the driver from visual distraction to ensure that our future roads are safer than ever.

Automotive gesture recognition comprises electronic systems is installed in automobiles as a part of the human-machine interface (HMI).

In July 2018, Microchip Technology released the MGC3140, a 3D gesture recognition controller that claimed to offer the lowest system cost for advanced automotive HMI designs. The single-chip solution is AEC-Q100-qualified capacitive technology-based air gesture controller that provides reliable sensing in full sunlight and with sensors of any conductive material.

In February 2019, BYTON announced its partnership with PMD Technologies AG with an aim to use their 3D Time-of-Flight (ToF) sensors for the in-car gesture control camera system operating the Shared Experience Display in BYTON's first production model, the M-Byte SUV. The pmd 3D ToF sensor has a set of illuminators at the top of M-Byte's Camera that emits invisible light into the car cockpit. The sensor measures the time it takes for the camera light to bounce back from objects and person enabling the in-car gesture control camera system. In May 2016, Continental announced that it has integrated gesture-based control into the area of the center console and steering wheel, enabling drivers to control functions with just a swipe of their hand or motion of their fingers. These systems use near-infrared (NIR) light in the 850-940 nm range, applying structured light and time of flight (TOF) methods to convert the hand positions and gestures of the driver detected by the sensor into actions.

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Image Source: Continental AG

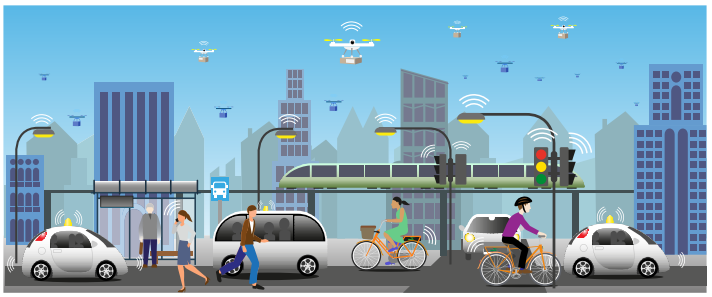
Continental Integrates Gesture-Based Control into the Steering Wheel

In May 2017, SoftKinetic®, 3D vision and gesture recognition solutions provider announced that its 3D Time of Flight (ToF) vision technologies would be included in the 2017 BMW 5 Series cars. The company also powered infotainment gesture control in the BMW 7 Series luxury line.

Sony unveiled its All-Electric Vision-S Concept Car at CES 2020 and announced that it was also making investments into LIDAR and Time of Flight (ToF) camera technologies to provide an optimised infotainment system that features gesture control.

Micromobility

Micromobility is emerging as an alternative travel solution for short distances which involves



lightweight, low-speed vehicles that can be shared or privately-owned, and are pushed, pedalled or electrically powered. It offers innovative and quick solutions to resolve issues such as parking and traffic congestion. Many cities are creating cycle lanes and car-free zones to help ease overcrowding on shared and public transport for encouraging the use of private micromobility vehicles.

Some of the pilot projects in this direction are-

Micromobility model in Munich was experimented in 2019 to provide a perspective on how mobility in the city could develop via three different scenarios. Experiment of e-scooter cruising in Munich's street for 100 days with six e-scooter companies- Bird, Circ, Hive, Lime, Tier, and Voi; supporting the initiative, and installed more than 2,000 shared e-scooters within the first 100 days. It was a successful experiment which reduced time of travellers with jam free journey, proving to be a medium to fill the first- and last-mile gaps in public-transport.

Companies like Citi Bike and Jump Bikes in US and Ofo and Mobike in China are providing suitable options to the consumers for last-mile transportation.

Conclusion

Modern Smart Vehicles will be more like connected computers on wheels that will generate huge amounts of data. Companies have started combining the cutting-edge emerging technologies in the automotive functions which will speed up the pace of innovation drastically to make the car a "Classy Drawing Room or Meeting Room on Wheels". For making this a reality, automakers need to build strategic cross-industry partnerships with technology companies to bring 'software-defined' vehicles and keep ahead of the competition. ❑

Convergence of emerging technologies in automotive will eventually make the car a "Classy Drawing Room or Meeting Room on Wheels"

AUTHORS

ANUJ SINHA
Deputy CEO
Telematics Wire

YASHI MITTAL
Manager- Corporate Communication
Telematics Wire

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OEMS JOURNEY TO PRE-COVID MANUFACTURING, SALES AND OVERALL GROWTH

Piaggio has been into manufacturing of a range of three-wheel public transport auto-rickshaws and light weight goods transport vehicles. They also manufacture electric two-wheel motorcycles. With OEMs across the board taking a hit from lockdown, the path to recovery for each of them will be a journey to be followed and learnings taken out of it. In this context, Telematics Wire discussed with Diego Graffi, Chairman & Managing Director, Piaggio Vehicles Pvt Limited Following are the excerpts of discussion-

DIEGO GRAFFI
CHAIRMAN & MANAGING DIRECTOR
PIAGGIO VEHICLES PVT LIMITED

The COVID19 has left automakers in difficult situation. What will be important step going forward- production, sales, finance management or something else?

Biggest limitations we see now for increasing sales turnover are as follows:

- Restrictions for dealers that are allowed to open to operate fully without limitations of timing and manpower;
- Willingness of financiers to take new cases, mainly for 3w passenger segment, due to limitations and restriction imposed for these vehicles to ply on roads in large part of India;
- Availability of manpower for supply chain, which is impacting their production capacity
- Overall weak sentiment in customers, due to uncertainty of the situation related to way forward for lockdown relaxations

In general we have seen some positive signals for recovery in first 15 days of June , but now rumours related to some states that are thinking to reimposing lockdown again (though unreasonably, since it will not stop spread of virus) is again hampering the recovery, dangerously since it will create further confusion in the entire ecosystem

Will automakers look forward to more of automation in coming years. Could automation insulate production from such pandemics?

In our sector we have already introduced full automation in some critical operations but being a manpower dependant kind of production it is not possible to think that automation can be the solution.

Can we expect Piaggio to launch new models in coming months. If yes, will they be tuned to address certain needs or change in market demand?

Notwithstanding the heavy impact of extended lockdown in our revenues, we have maintained fully our investment plan in new products both for CV and scooter business; we are going to launch the new Aprilia SXR 160 before the end of this year. It wasexhibited at AutoExpo 2020 in Delhi NCR in Feb'20 this year. This new scooter is about creating a new category, a sort of crossover between a sport bike and a maxi scooter though maintaining compact sizes. We will be introducing new electric 3w vehicle with swappable and fixed battery configuration, following big success achieved with Ape E City launched in Delhi at the end of 2019. We will also launch a new alternate fuel powertrain for our 3w portfolio, which can be a valid alternative to diesel ones in terms of performances, total cost of ownership and payload.

Will the lesser use of public transport due to COVID19, lead to increased personal mobility like scooters and motorcycles? Will Piaggio benefit from this?

We are in 3w passenger segment historically, so the limitation to shared mobility as a consequence of social distancing norms definitely will impact negatively the demand of this category of vehicles in the following, and we have seen already the effect in last 3 weeks since we restarted retail; in scooter business instead we see definitely a good opportunity for quicker business recovery in following period though not enough to regain gap respect to sales' figures of last year same period.

What will be the effect of COVID-19 on the EV Industry?

There could be chances of EV growth in India being impacted from potential defocus from government and state authorities on infrastructures' investment, due to COVID-19 crisis. Another impact could come from OE suppressing investments on EV product portfolio development. There could be instead a benefit coming from big players of E commerce in India looking more interestingly to EV cargo solutions for effective last mile connectivity.

The majority of EVs are powered by lithium-ion batteries but its cost is high. Do you think India, being a price-sensitive market will explore other battery technologies?

We expect cost of Li-ion battery to come down consistently in India in the next 2- 3 years, along with progressive localization of manufacturing of battery packs. We have already seen a positive downward trend in cost of battery in the last 3 years, but not yet enough to render the cost of electric vehicles competitive with ICE ones.

What are your views about FAME-II?

Can work for creating initial demand, compensating partially the gap in prices between electric vehicles and ICE ones, but if we want to create medium to long term robustness of electric mobility in India, investments for charging infrastructures development or for supply chain to localize components in India will be more helpful.

How viable is the concept of battery swapping, in your opinion?

Very viable, since it breaks the two biggest barriers that actually exist to convince customers to adopt an EV instead of a conventional ICE vehicles for his mobility needs:

- Gap in cost of acquisition in respect to ICE vehicles, since cost of battery is not part of vehicle price but it is owned by a third party ;
- Range anxiety, since customer do not have to wait 4- 5 hours for his vehicle to be recharged but in just 2 minutes can do battery swap and restart plying his vehicle on road

The limitations coming from availability of infrastructures (independently if they are for recharging or for battery swap) remain same as for onboard fixed battery solutions.

As Piaggio has stepped into the era of connected mobility, how do you think the end user will benefit in days to come?

Yes, we have successfully introduced connectivity into our EV 3w Ape e-city: through an app installed on his phone which dialogues with the vehicle, the customer at any point in time can check remaining charge of battery and autonomy of vehicle, can do basic diagnostic on vehicle functioning, can check on average speed of the day and kilometres run, can locate the nearest location for battery swap and number of batteries available there and lot other things.Also in our scooter gamma we have introduced connectivity solutions that can allow customer to locate his vehicle in a parking lot, ask for service online, send a distress call if in panic and lot other possibilities.

Definitely we think that connected vehicles are the future of mobility in India, since they offer customers immense possibilities beyond the pure usage of the vehicle itself for commuting or for doing business. ❑

BUILDING SAFE, SECURE AND RELIABLE AUTONOMOUS VEHICLES

RAGHAVENDRA BHAT
ANSYS

Nearly 15 years ago, autonomous driving was a science fiction. Today, the world is fast moving towards this goal with many OEMs already in advanced stages of testing their prototypes. Autonomy is being considered and built into everything that in the past, relied on the humans to make decisions. We see this trend catching up from flying machines to ground vehicles to everything in between, including ships and vessels.

It all started with automation. Humans are creative creatures that do not like repetitive and monotonous tasks. We find every opportunity to automate something that is not mentally stimulating. This curious extension to automation today has grown into a full-fledged autonomous phenomenon replacing humans from most unlikely places.

In our experience, every time a machine replaced a human – that job never came back to humans. This is because machines do the job much better than the humans they replace. Machines have stretched the boundaries in every sense – be it speed, precision, accuracy, reliability or safety. So far, in all the mechanization scenarios, the informed decision making has been with humans.

Can you trust an autonomous vehicle?

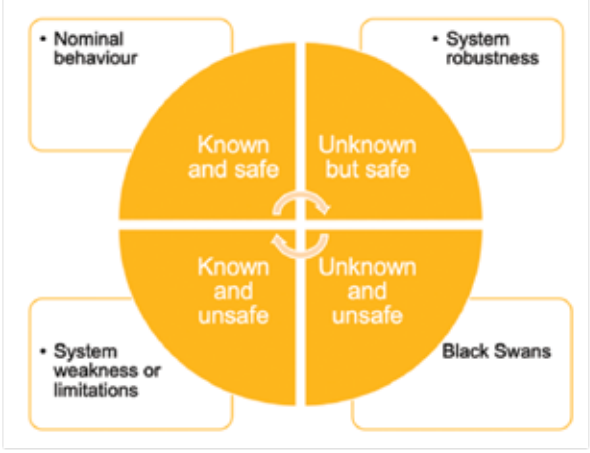
When machines are becoming autonomous, it means that they are designed to make decisions on their own, independent of human intervention. This brings a new set of challenges. Trust is an invisible thread that underlines all human interactions. Today, when we take a Taxi, we trust the driver knows his job and that he or she will safely drive us to our destination. When there is no driver in your Taxi, who do you place your trust on? How do you know that the machine is trained to handle all likely scenarios? How do you trust that the machine will not compromise your safety? How do you trust that the Taxi you are in, is not under the control of some unscrupulous elements that don't mean well to you?

Picture 1: Real world scenario is complex

In 2018, SAE International had conducted a survey for Ansys, where nearly 80% of the participants said that they don't feel safe in a fully autonomous vehicle. Building trust and confidence in autonomous vehicles is a key challenge for people to fully adopt the technology.

Reliability of autonomous vehicles

In an autonomous vehicle, the primary decision making is done by Artificial Intelligence (AI) based software. A specialized branch of AI called machine learning (ML) / deep learning (DL) algorithms make decisions that are based on our understanding of how neural network of human brain works. Our eyes provide visual sensory inputs based on which the brain creates a perspective that provides image recognition and creates depth perception. The human brain can process many additional information and use its learning from real world experiences (intuition) – to make decisions even when it encounters a scenario that it never dealt with before.



Picture 2: Real life driving scenarios

This is where things become challenging for artificial intelligence.

The AI based perception algorithm learns from manually labeled training data from scenarios. Higher training data sets can improve the ability of perception software. However, it is impossible to cover every conceivable scenario. We can group scenarios into known and unknown classes. In each class, the vehicle behaviour may be classified as safe or unsafe. The most dangerous combination involves unknown and unsafe scenarios, also called Black Swans. Training the perception software to cover this class of scenarios is not possible as we do not know them.

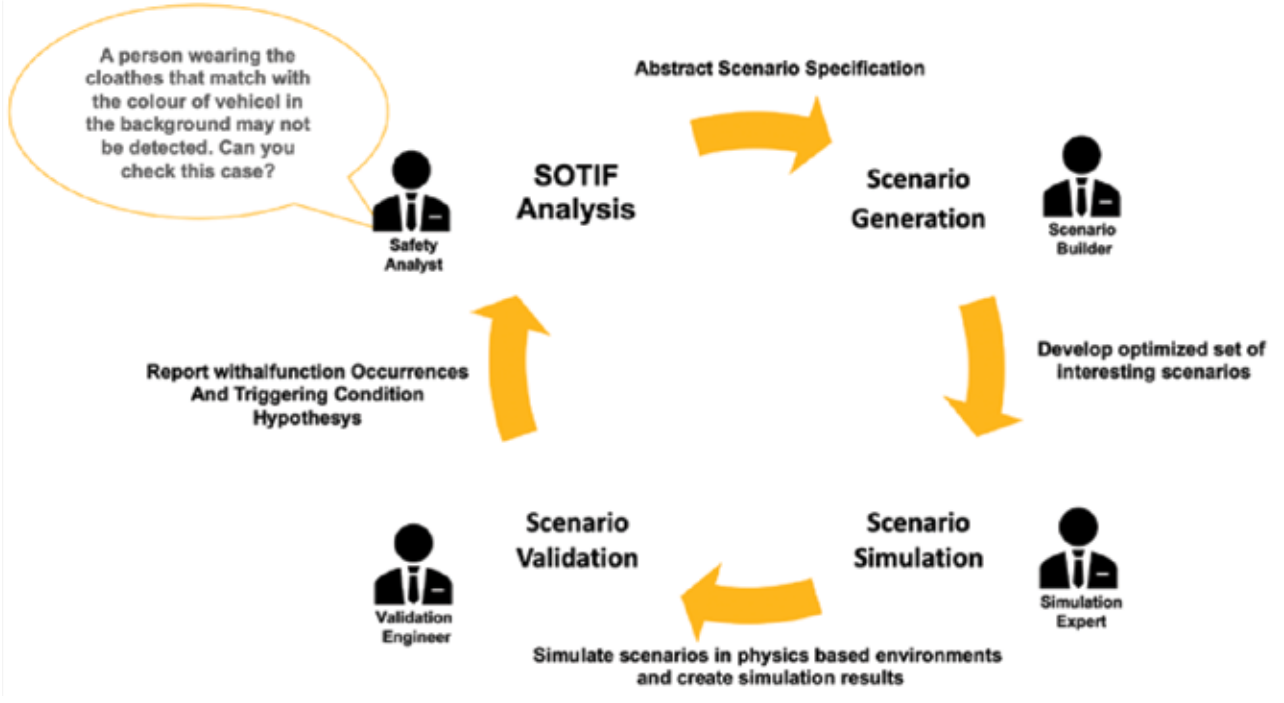
When we look at safe and unsafe situations for known scenarios, we can quickly realize that any known safe situation can turn into an unsafe, due to unfavorable environmental conditions. A scenario which seems to be playing out perfectly normal under a regular situation may fail due to an incremental change in weather condition. A flickering road lamp or a lightning may cause the perception algorithm to read the road signs incorrectly. An AI software that can detect adult humans with high degree of confidence may fail to detect a child or a person on wheelchair. There might be occasional wildlife crossing the road. It is totally unacceptable for an autonomous car to not detect these vulnerable road users. These are typically called edge cases or corner cases – that an AI software should manage safely.

The manual methods used by perception system engineers is to label objects in videos and then program their autonomous perception systems to respond correctly - are time consuming and expensive. Given their time and cost prohibitive nature, it simply doesn't make sense to rely on these manual methods to identify every conceivable edge case. Unique solutions that are designed with the practical needs of perception system developers can help improve the robustness of the perception algorithms.

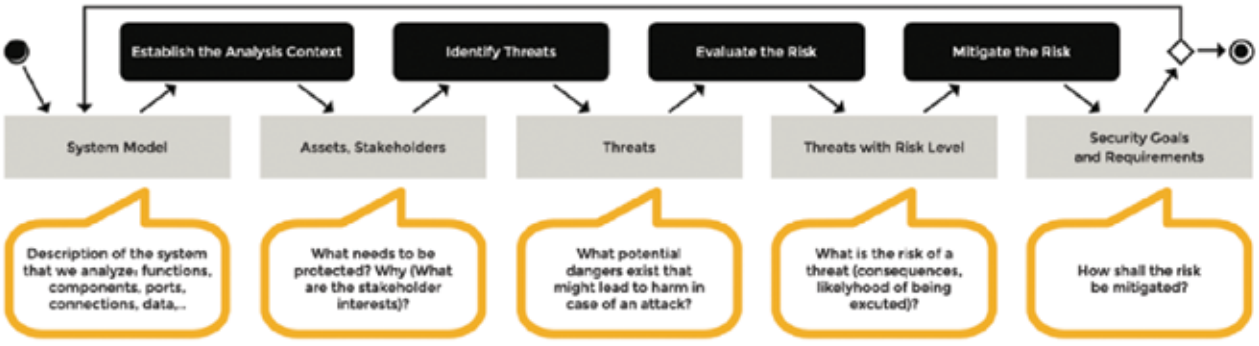
Safety is non-negotiable

Safety is a very important topic when it comes to automotive, especially with autonomous vehicles. ADAS and AD are heavily dependent on numerous ECUs to provide driving and safety functions. ISO 26262 provides detailed guidelines to understand various risks due to malfunctions and recommendations to mitigate the same to acceptable level. The ISO 26262 standard has been the current state of the art which is widely practised in the industry to ensure safety.

While functional safety covers risks associated with malfunctions due to failures in electronics, defects in software or manufacturing process, Autonomous Vehicles also have to deal with risks due to insufficiency of autonomous functions, known as safety of the intended functionality or SOTIF. This



Picture 3: Integrated SOTIF analysis



Picture 4: Cyber Security Analysis

covers areas such as limitations of sensors, insufficiently defined algorithms or reasonable misuse.

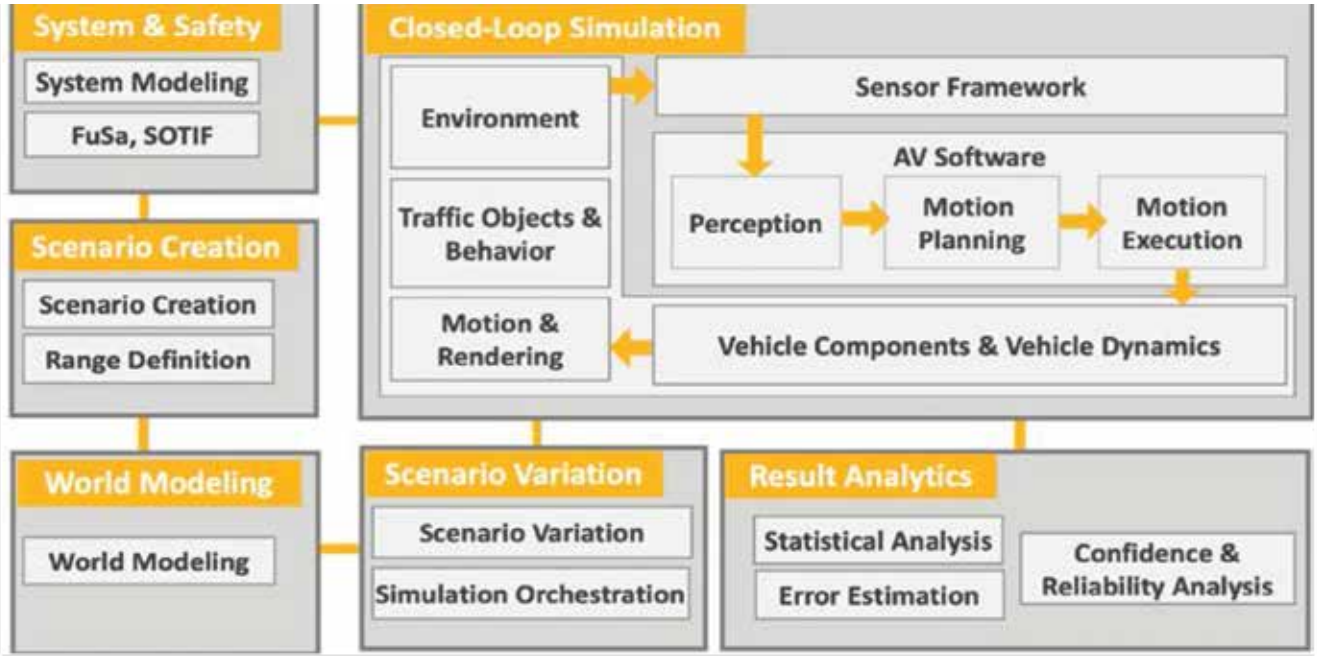
Sensor limitations may include situations where a camera sensor reaches saturation due to extremely bright light (which may be due to an oncoming vehicle) or a patch of dirt stuck at the lens affecting camera functions. Insufficiency of algorithm could limit the ability of perception software to identify a specific kind of road sign or object, in certain geographical locations. A driver may not respond to a system event within specified time which is typical misuse to be expected of from humans. An autonomous vehicle has to consider all these (and more) possibilities so that functions are executed as intended, without causing safety issues.

Autonomous driving requires a huge amount of road testing by practically driving these cars in all traffic situations on public roads. How many miles would autonomous vehicles have to be driven to demonstrate their failure rate to a particular degree of precision? As per a research article published by RAND Corporation, "this number is approximately 8.8 billion miles. With a fleet of 100 autonomous vehicles being test-driven 24 hours a day, 365 days a year at an average speed of 25 miles per hour, this would take about 400 years"

It is not possible to achieve this target with road testing alone. An alternate approach is to simulate majority of the scenarios including what-if scenarios, in a physics based virtual environment. Safety analysist can start with the analysis of SOTIF triggering conditions, which can be used to develop a variety of optimized, parametric scenarios that can be simulated in a virtual environment and edge cases can be identified in synthetic video. Virtual simulations provide best of both worlds – to provide an extensive coverage of scenarios covering billions of miles, without causing risk to the lives of people and the physics behind these simulations ensures the results are accurate and as close to the real world as possible.

Cyber physical systems are always targeted for security exploitation

Autonomous cars are cyber physical systems that are practically computers on wheels. These vehicles rely extensively on connected infrastructure to ensure safety and deliver superior user experience. However, these functions can potentially offer opportunities for an intruder to hack into vehicle systems. Successful attacks might cause data leak causing privacy issues and progressively take control over the vehicle functions. This may result in denial of service where a vehicle may become unavailable to service the needs of its legal owner. Financial risk including the damage to properties is a likely scenario. Deliberate acts of misleading the perception algorithm can turn out to be the most dangerous hack. Most importantly, loss of security also means loss of safety. A compromised autonomous vehicle can



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pose serious risk to lives of people and instill fear thus breaking the confidence for adoption.

The autonomous vehicles must be systematically analyzed for every possible security threat by identifying vulnerable assets and performing threat analysis and risk assessment. Any unreasonable risk must be systematically resolved. Certain functions that are too risky may have to be discontinued. However, it must be noted that improving the security comes at significant cost. Apart from redesigned safety functions, hardware with higher performance (to deal with encryption / decryption), additional security specific functions, and the vehicles must be continuously monitored for security exploitation throughout their lifetime, across the markets.

Conclusion:

The real driving force behind the autonomous vehicles are reliability, safety and security. As discussed before, it is important to ensure that autonomous decisions taken by the system are most appropriate, for the situation. Be it ensuring the correct behavior of sensors, robustness of perception software or deterministic controls coupled with driving situation simulations – physics-based simulation is the closest we can get to real road testing.

Picture 5: Autonomous driving simulation architecture

Developing a fully autonomous vehicle that never causes risk to humans is a far-fetched idea. The collective effort of the industry is to make autonomous cars much more safe, secure and reliable than humans. An integrated approach that complements virtual simulations with safety and security perspective can help address most concerns and get us closer to realizing trustworthy autonomous vehicles.

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AUTHOR

Raghavendra Bhat is Technical Manager for India, South East Asia for SBU at ANSYS. Earlier, heworked for Esterel, IBM and Telelogic. He work experience includes-SDLC including requirements management, software configuration management and model based design & development. He has M.Tech(Software Systems) from Birla Institute of Technology and Science, BE(E&C) from VTU and a Diploma in Electronics.

Software Considerations in AIS 140 for Vehicle Tracking System: Is it enough?

SHREYANSH SHUKLA
LDRA TECHNOLOGY PVT. LTD.

Advances in hardware and software due to increased performance and miniaturization, combined with continuous effort to reduce costs of products and services encourage the deployment of VTS. Being an embedded device, there are already a few studies available concerning the safety and security risks of such VTS. With an intent to lead from the front, India has AIS 140 standard, envisioning to address safety and security challenges of VTS development and deployment.

Regulation in India: Rule 125H of the Central Motor Vehicle Rules (CMVR) 1989 mandates the installation of Vehicle Location Tracking (VLT) device and emergency button for the new public service vehicle registered after 1st January 2019. This rule is not applicable for two-wheelers, e-rickshaw, three-wheelers and any transport vehicles for which permit is not required under the Motor Vehicle Act, 1988. VLT device manufacturers will have to get their devices tested and certified from the testing agencies referred to in rule 126 of the CMVR for compliance with the rule 125H of CMVR.

AIS-140 titled "Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation" was published originally in October 2016. There were 2 amendments to AIS 140 i.e. dated 11th December 2017 and 5th December 2018 respectively. This standard applies to both individual components as well as system environments to be used in public transport vehicles.

Software Considerations: VTS is a complex co-functioning of Hardware and software. Considering the software aspects, the following are the observations as per AIS 140.

- **Need:** Table 3A defines "safety & security" as a function of the VLT & emergency button.
- **Maintainability:** As per Clause 3.1.1.9, the device shall support over the air software and configuration update.
  - Alert ID 12 "Alert over the air parameter change", when any parameter is changed over the air. Alert shall include the name of parameter changed and source of the command.
  - As per Clause 4.3, Testing of device configuration as over the air.
  - Clause 6.2.1.5 is about updating the firmware of the system from back-end control centre only.
- **Control:** As per Amendment 2 of AIS 140, The VLT device manufacturers shall ensure that a control mechanism is established for the secure data transfer from VLT to the backend system and that only the authorized devices transfer data to the backend system.

- **Security Requirements:** As per Clause 3.1.1.25 for functional requirement, VLT devices shall have a provision of secured data transmission to the Backend Control Centre from the devices through a secured channel (e.g. secured dedicated APN).
- **Software Change Management:** As per Annexure B, Criteria for extension of type approval indicates if there is a change in software of the ITS system, then the functional verification at system integration level to be conducted.
- **Liability:** AIS 140 doesn't include the liability clauses, however, it demands that Firmware of the device needs to be available for auditing to notified testing agencies

In addition to the above observations, figure 1 highlights security considerations in the AIS 140 standard.

Software Tests required as per AIS 140

Considering the above software considerations, AIS 140 prescribes software tests that are required for a safe and secure VTS. Clause 6.3 of AIS 140 defines the device level functional tests, performance & durability tests, environmental tests and protocol tests. Apart from these device-level tests, in Amendment 2, a new clause 8.0 for Code of Practice (COP) is included for implementation of VLT device with emergency button and command & control centres. Some of the practices are mentioned below:

1. The VLT device manufacturers shall ensure that a control mechanism is established for the secure data transfer from VLT to the backend system and that only the authorized devices transfer data to the backend system.
2. Clause 8.3 (s) defines that the system shall provide >99% availability, Vulnerability Analysis & Penetration Testing (VAPT) as per guidelines issued by the Ministry of Electronics, Information & Technology, GOI. Further, Table 2 of Clause 8.5 (c) defines that the VLT device manufacturers must provide a VAPT report from a 3rd party agency authorized by CERT-In/STQC.
3. Test Parameters for auditing of VLT Device Manufacturer's Backend Application/System as per Table 2 of Clause 8.5 (c). Some of which are as follows:
   a. Test details for firmware over-the-air update
   b. Application availability test
   c. Testing functionality of applications

Figure 1

10 Best Practices for System Software Safety & Security: Considering the need and requirement for VTS as per AIS 140, the following 10 best practices are advised for system software safety & security

1. Avoid Top 25 most dangerous software errors by CWE and follow Top 10 Secure Coding Best Practices by SEI CERT. There are 2 bonus practices additionally i.e. to model threat and to define security requirements.
2. Avoid inducing known security vulnerabilities in the code. Vulnerability dictionary like CWE and CVE can be referred to. Inferences from the coding guidelines such as MISRA, CERT can also be considered.
3. To ensure that software complexity is low, software quality characteristics (Reliability, Performance Efficiency, Security & Maintainability) by the Consortium for Information & Software Quality (CISQ) can be considered.
4. Ensuring the attack surface as low as possible should be the primary effort. Performing design review, call graphs/ flow graphs are some of the best practices to achieve this.
5. Making sure of no dead code or unreachable code.
6. Establish bi-directional traceability between high-level system requirements to low-level requirements, to code, to test cases, and perform the impact analysis when there is a change in requirement.
7. Suggested Tests: Penetration Testing, Unit Testing, System & Integration Testing, Robustness Testing, Fuzz Testing, Requirements based Testing, etc. These test methods will help to make the VTS system safe & secure.
8. Focus on proactive approach rather than a reactive approach and consider Functional Safety & Cyber Security in an early stage.
9. In addition to AIS 140, Follow the software life cycle processes mentioned in functional safety standard ISO 26262 Part 6 or IEEE 12207 which is a standard for "Systems and software engineering – Software life cycle processes".
10. The use of qualified tools in the software development lifecycle.

Conclusion

AIS 140 considers software as an integral part of the vehicle tracking system. With Amendment 2, there is an emphasis on security & software tests such as VAPT analysis, etc. Though these tests are very important, these are not enough to make software safe & secure. There is no single bullet to ensure that software is safe & secure instead it's an ongoing process. The observed 10 best practices above would help VTS manufacturers to be one step ahead in the competition in making world-class products. ❑

AUTHOR

Shreyansh Shukla is a Field Application Engineer at LDRA Technology Pvt Ltd. He holds a B.Tech. degree in ECE and a Post Graduate Diploma in Embedded System Design from CDAC, Noida. He has been associated with embedded software industry for over 5 years. Presently, he is actively guiding customers on the usage of LDRA tool suite for Safe & Secure Coding.

ELECTRIFYING URBAN MOBILITY

NEETA SRIKANTH, VIVEK OGRA
PRICEWATERHOUSECOOPERS PVT LTD

Urban mobility is changing at a pace faster than we can imagine, challenging the traditional vehicle-led planning model followed in transportation. Even before the current crisis, the sector was facing disruption largely in the form of new ride-hailing and ride-sharing models, leading to a paradigm shift in mobility as a service (MaaS). Recent events have accelerated this change as communities discover new ways to bridge distances through technology. People have become more conscious about the environmental impact of human activities and what essential really means. Commuter expectations have evolved and there is increased awareness about a more connected and shared transport model. Public transportation needs to reinvent itself to meet these demands in the new normal.

Urban commuters are choosing the mode of conveyance that lies at the intersection of their needs and the city context. Commuters expect accessible, convenient and pocket-friendly journeys. The value of time has gone up – so why spend it in transit? In cities, pollution, traffic congestion and rising fuel prices are driving the adoption of shared, more sustainable transportation models. Mobility services need to rethink customer experience and the customer journey cycle – starting from door-to-door pickup to their end point – and look at optimising operations in order to be competitive and sustainable in a densely populated urban environment. As a potential solution, electric mobility offers differentiation and a strong value proposition.

Use case	2W	3W	4W	HCV
Public transport	Low	Low	-	Medium
Commercial mobility service (passenger)	Low	Low	Low	High
Commercial mobility service (goods)	Low	Medium	High	High
Private vehicle owner	Low	-	High	-

Low Medium High

Table 2: Indicative TCO viability (with subsidy under FAME II)
Vehicle form factors considered are two-wheelers (2W) like bikes and scooters, three-wheeler (3W) – auto rickshaws for passenger and goods transport, four-wheelers (4W) including cars and light commercial vehicles, and heavy commercial vehicles (HCV) like buses and trucks

Recognising these advantages, there has been strong policy support in India through the FAME II scheme and state electric vehicle (EV) policies to drive the transition to electric mobility. Cities are at the heart of this transition, raising several important questions on how to drive the change.

When assessing the viability of going electric, the benefits in terms of total cost of ownership (TCO) for the mobility service provider and the technology constraints of EVs in the context of their application must be considered. Use cases as diverse as deploying electric buses in public transport fleets to electric scooters used by last-mile service providers weigh potential constraints like vehicle range, charging time and carrying capacity against the benefits of lower running costs, higher energy efficiency and zero tailpipe emissions. A comparison of the TCO of these EVs with business-as-usual internal combustion engine (ICE) vehicles will show where the transition to electric mobility is likely to have greater momentum.

As with any mode of transportation, there is a need for supporting infrastructure. While ICE vehicles need petrol pumps and gas stations, EVs need charging infrastructure. However, the same approach to both will not work. Fuel stations work on the assumption that the

	Electric vehicles	Internal combustion engines
Cost	Savings on recurring running cost on account of cheaper fuel prices, lower need for maintenance and improved energy efficiency	Savings on initial cost of acquisition
Operations	Facilitate more granular data collection that can be leveraged for smart, connected operations	Familiar mode of operations reduces need for change management
Emissions	Zero tailpipe emission; use of renewable energy for charging to realise more environment and cost benefits	Emissions from vehicles contribute to poor air quality in cities

Table 1: EVs vs ICE – benefits and challenges

Types of EVs		
BEV	Battery electric vehicle	Runs entirely on electricity stored in batteries
PHEV	(Plug-in) Hybrid electric vehicle	Has both battery and ICE systems as part of powertrain; battery can be recharged directly with electricity
HEV	Hybrid electric vehicle	Has both ICE and battery systems as part of powertrain; battery can only be recharged indirectly through regenerative braking or internal generator mechanism
FCEV	Fuel-cell electric vehicle	Electric powertrain running on energy generated from electrochemical fusion process of hydrogen and oxygen

Table 3: Different types of EVs

vehicle turnaround time is 5–10 minutes, whereas charging EVs can take anywhere between 30 minutes to 6 hours. This requirement is often highlighted as the main constraint on EV adoption, but the real issue is the approach, not the charging time. City vehicles are stationary almost 8–20 hours a day. By integrating charging and parking infrastructure in cities, this time can be utilised for charging EVs. In the case of fast charging stations, integration with parking in commercial establishments like malls and restaurants has become a cost-effective marketing strategy to attract the patronage of EV users.

EV technology brief

The differences in EV technology are largely determined by the approach to two key components – energy storage and recharging mechanism. In India, the current focus, from a technology standpoint, is on Li-ion battery electric vehicles (BEVs), i.e. electric vehicles that use Li-ion batteries for storage and can be recharged with electricity. This technology combination is fairly mature from a production perspective and several vehicle models from Indian and international OEMs are available in the market.

Li-ion batteries come in a variety of chemistries (e.g. lithium iron phosphate [LFP], lithium nickel manganese cobalt oxide [NMC]) with a trade-off between energy density, vehicle performance, safety, battery life and cost. Battery prices have been falling rapidly from $1100/kWh in 2010 to $156/kWh in 2019, and this has been a major driver for the adoption of electric mobility. The main challenges with this type of battery are sourcing of raw materials to produce cells indigenously, and safe disposal of the spent battery packs.

Charging infrastructure also can be of different types based on the rate of current (regular or fast charging), charging standard (e.g. CCS, CHAdeMO, GB/T, Bharat Charging Protocol) and method of power transmission (electric vehicle supply equipment [EVSE], inductive/conductive wireless charging).

What is the best way to go about driving adoption of EVs in urban mobility? Unfortunately, there is no standard solution for this – the approach will need to be customised based on the needs of the commuter and the city. For different applications, the benefits for the commuter, service provider and the city will need to be evaluated against the feasibility, return on investments and technology-associated risks of a project. Most new initiatives start with a well-structured pilot programme to test assumptions, pivot to different models as they encounter challenges, and scale up after finding the solution that addresses the needs of all the key stakeholders involved.

There are lighthouse projects for electric mobility in India that have been successfully implemented in cities as diverse as Delhi and Kochi, Silvassa and Bhubaneswar. A look at these projects and the lessons learnt might provide a few ideas on how movement in urban centres can be transformed. Largely, the initiatives taken by Indian cities can be grouped into e-bus procurement for adopting more sustainable public transport fleets under the FAME II scheme, encouraging e-auto and e-rickshaw adoption, investing in charging infrastructure networks, and support for transition to electric mobility for private commercial fleets and EV owners. Thus far, urban electric mobility initiatives have been approached in silos. However, the need of the hour is to adopt multimodal integration at the city level in order to rethink the way we move and emerge stronger from the lockdown. ❑

AUTHORS

VIVEK OGRA
Partner, Smart Mobility
PricewaterhouseCoopers Pvt Ltd

Vivek Ogra leads the Smart Mobility practice at PWC India and has more than 23 years of experience in designing smart mobility systems globally, including intelligent transit management systems, intelligent traffic management, transport operations planning and management, revenue management, and transit business intelligence. Vivek works closely with government institutions and private mobility service providers to formulate policies and design smart mobility systems, including a focus on AI in transport. He is immediate past chairman of GESIA and is also a key member of various industry organisations.

NEETA SRIKANTH
Manager, Smart Mobility
PricewaterhouseCoopers Pvt Ltd

Neeta Srikanth has 7 years of experience innovating across emerging industries like electric mobility, click and brick retail, and social enterprise. Currently a Principal Consultant with PwC, she has worked on engagements with State Departments on EV policy and implementation, electric bus procurement, smart city IPT delivery through e-auto deployment, and advisory engagements with funding agencies and private firms exploring B2G electric mobility solutions.

VOICE ASSISTANCE SYSTEM IN FLEET MANAGEMENT

TUSHAR BHAGAT
UFFIZIO INDIA SOFTWARE PVT LTD

As a fleet manager, wouldn't it be great if you are able to get insights of your fleet just by talking to your fleet management software ? Voice assistants are becoming an essential part of our day to day life, so why not integrate them with our fleet management software ?

Nowadays, fleets have been using an innovative and advanced predictive analytics system which helps them to gain key business insights into what causes accidents or driver behaviour turnover. In today's digital era, combining predictive modelling with voice-assisted technology is a powerful new way to increase fleet efficiencies.

It's evident that within the few years of span the voice assistance technology has shown remarkable improvement in the telematics field. With the continued development in voice technology, there have been additional benefits to telematics business applications, and such potential impact can be seen on the role of the vehicle drivers.

In the current scenario, if an operator wants to access their vehicles data, they have to go through multiple databases, gather multiple vehicle information and even have to check their trip schedule and to-do list which in turn can be more time consuming and delay in the trip. However, with the help of a voice assistant, drivers will no longer be required to interrupt their on-going trips to collect and analyze GPS Tracking Performance, or any fault in the vehicles. Instead, the voice assistant technology will provide them with the vehicle insights moments, in a faster, easier and more accurate manner.

During the journey, if any serious problem arises the voice assistance tells the drivers what kind of action can be taken and they need to find a safe solution immediately, or just show them the sign of warning and they can get to their next stop and have someone look at it.

Other future applications like ADAS could involve voice assistants and interact with drivers about the lane deviation, warn or make an announcement of upcoming road obstacles. These technologies could provide verbal instructions, or automatically make contact with fleet authorities if a driver is in danger and calls out for the help.

Nowadays, Fuel theft is one of the main concerns for fleet owners. Many times we have heard or some of us have already faced that fuel from their vehicles has been stolen. The voice assistant with the help of GSM and sensors measure the fuel flow rate by measuring the distance of fuel level with respect to time. The sensor gets activated and sends a signal and voice command alerts to the driver and manager when there is a sudden change in fuel flow rate or fuel consumption rate of the vehicle.

How easy our lives have become with voice assistants!

The virtual voice assistant is already changing our lives and this advancement can be soon seen in the fleet industry as well. How? Through a Smart fleet management system with voice recognitionintegration.

Presently, a lot of fleet management solutions service providers have already implemented this into their system making the lives of fleet managers easier. Fleet managers, single-handedly manage a lot of tasks which causes unnecessary communication issues, delays and overall lack of operational efficiency.

Easy Access to fleet data through voice assistant integration

A fleet management system offers a great variety of tools that enables speed management, geofencing, driver management, service management and much more. By providing quick updates and channelling proper communication, Fleet managers are required to stay up on their toes always. By integrated Amazon Alexa and Google Siri, fleet managers now get access to all the fleet data by simply asking.

Another way to make fleet management smarter is to integrate a chatbots system. Here the communication will be done via text from a computer to the drivers. This takes off the burden of small and mundane tasks from the shoulders of fleet managers. Chatbots and Alexa for vehicles can be customized as per the user requirement. ❑

AUTHOR

TUSHAR BHAGAT
Director
Uffizio India Software Pvt Ltd

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- A telemetry system is installed in every Fuel Tank
- Tank-level measurements are regularly sent to a Telematic device. This Device, via the GSM network, transmits the data to the cloud, which automatically processes the data.
- The customers automatically get tank levels info, tank filling info on their email and mobile phone. They can even view and analyse the data directly in the user-friendly Callcommtracking.com web portal, from their office the customer can also get access to view it on their smartphone.

Understanding and managing the generator fuel level is critical. With the increasing cost of fuel, providers need to manage the operating expense both at individual sites and across the network. It is important to monitor fuel levels to facilitate timely refills and know how much time remains while under load.

To manage fuel effectively, thresholds should be user definable

a.) For low fuel - Once the low level is reached, automatic notification to the relevant personnel will be initiated.

b.) Fuel consumption is higher than the "normal" consumption rate- This is often caused by a leak or fuel theft; an alarm will be automatically generated.

Alarm notification and reporting Managing generators, especially at remote cell sites, can be challenging. However, with the right alarm notifications and reporting capabilities, information should be easy to access, and issues can be resolved quickly. Whether for preventative maintenance or issue resolution, understanding that a problem exists is the first step to operating a generator effectively and efficiently. Alarming should be utilized to understand various aspects of the generator, such as fuel levels or abnormal fuel consumption, if the generator is running or stopped.

c.) Email/ SMS alert on low level, fuel filling, fuel theft is generated instantly.

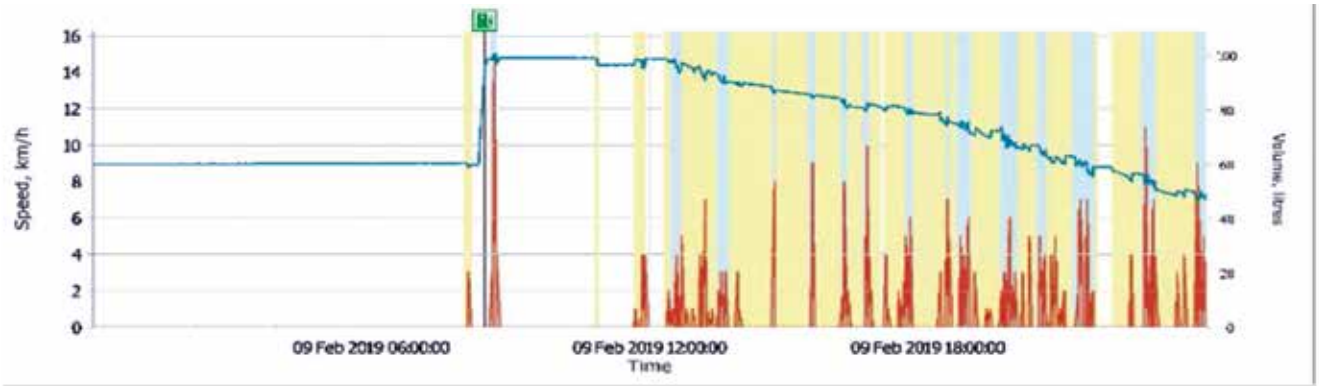
d.) Daily/Weekly/Monthly reports for monitoring consumption, filling & theft.

CASE STUDY-

We have Installed Fuel monitoring systems in many Genset at various Construction sites, we have observed that in remote site areas, the fuel filling is less than the actual billing done by the vendors or service providers. In one of the cases in ORISSA, we have observed that the service provider claims he has filled the tank with 120 litres on 9th FEB 2019 but when our system shows that only 40 litres was filled.

SENSOR CHART-

The chart clearly shows that 40 litres diesel was filled on 9th FEB 2019 but according to the service provider they have filled 120 litres.



SERVICE PROVIDER REPORT-

Here you can see on 9th February, he claims to fill 120 litres, but our sensor shows only 40 litres hence there is a theft of 80 litres. This is for one day one genset, if we assume this happens only once in a month then also the company losses-80x66= 5280/- per month per genset.

Self loading concrete machine

Date	Start HMR / KMR Reading (A)	End HMR / KMR Reading (B)	Actual Working hour	Actual Fuel issued	Fuel sensor working hour	Fuel sensor diesel issued	Difference working hour	Difference diesel
08-Feb-19	#REF!	1752	#REF!	50	23	49,48	#REF!	0,52
09-Feb-19	1752	1769	17	120	23	40	6	80

BENEFITS OF FUEL MANAGEMENT SOLUTION-

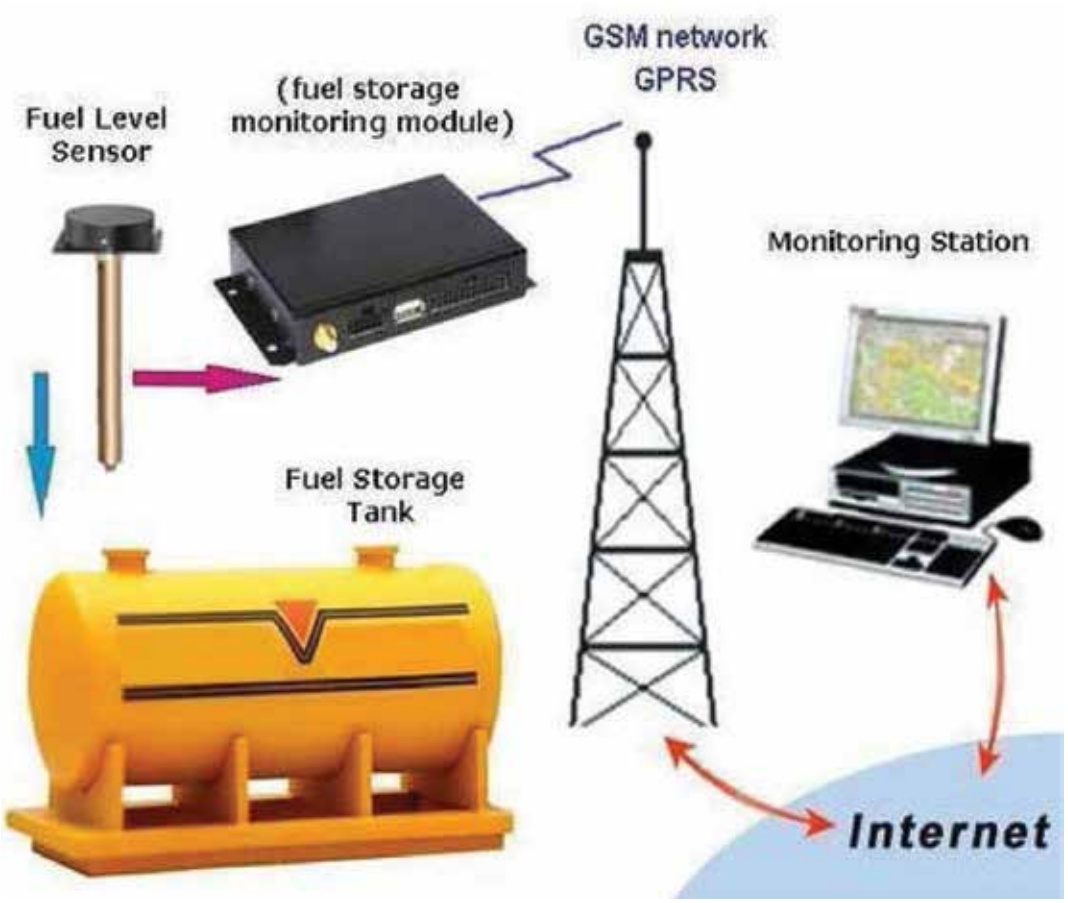
1. Lower operating costs, improve efficiencies, and increase reliability.
2. Reduce capital costs

CALLCOMM FUEL LEVEL SENSOR ESCORT TD-600

Reliable work in any conditions "Escort TD-600" – universal capacitive fuel level sensor that has 5 operational modes and can communicate with any GPS monitoring device.

All the materials and components are protected by robust casing and are proved to withstand extreme temperature drops from -60/+85 °C. Conforms to high quality and security standards stated by the certification system. TD-600 has high Ingress protection IP67 and galvanic isolation along the entire casing.

As the tanks at your site are bigger in size, we will install pre-calibrated sensor for all of your tank so calibration is not required. The Sensor will be installed in the tank and will be connected to a GPS/GPRS hub for transmitting the data. ❑



CALLCOMM FUEL MONITORING SYSTEM MONITORS FUEL FILLED AND ALLOWS FOR THE COLLECTION OF ESSENTIAL DATA AND GENERATION OF REPORTS FOR MANAGEMENT PURPOSES. IT HAS FUNCTIONALITY FOR RECONCILIATION AND COMPLIANCE.

AUTHOR

SANJAY JAIN
CEO
Callcomm

How Much Fuel Is Really in Your Tank?

MOHIT MEHROTRA
OMNICOMM INDIA

It's no surprise to any fleet owner to learn that fuel is a massive operational expense. Fuel and labor can constitute up to 50% of operational spend for any business with a vehicle fleet*, so managing fuel effectively is critical. 49% of companies that implement fleet monitoring solutions report fuel savings as a benefit, ** and companies save 20-25% on average on fuel with a fleet monitoring solution in place. ***

Businesses need accurate fuel monitoring to minimize inefficient driving, vehicle idling, fuel wastage and fraud. But which technology is best?

Fuel Consumption vs Fuel Level

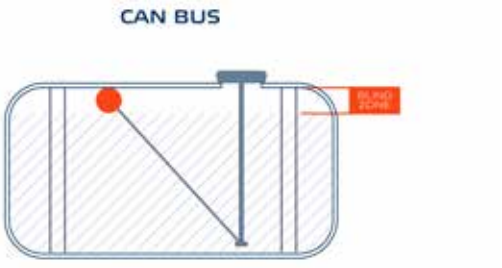
The difference between fuel consumption and fuel levels is very important. Fuel consumption data tells you how far a vehicle goes on a liter of fuel. However, only fuel level data can help you detect inefficient fuel usage and fraud.

Top Industry Technologies

Let's take a look at a few leading fuel measurement technologies.

CAN bus sensors

There are two types of these popular devices.



CAN bus injector sensors deliver information about fuel injection into the engine cylinders. They assess consumption while driving. CAN bus float sensors combine a float and float value switch in the form of a variable resistor. They evaluate how full the fuel tank is.

Some fleet operators use both to create an enhanced measurement system. CAN bus sensors cannot be installed on vehicles manufactured before 2000 and certain special transport vehicles.

SENSOR TYPE	REFUELLING & DRAINAGE CONTROL	INACCURACY, %	INSTALLATION COMPLEXITY	UNIVERSAL USE	CONS
CAN BUS FLOAT SENSOR	YES	±20%	MODERATE	NO	• Blind zones in fuel tank • CAN manufacturer proprietary monitoring system • Proprietary for each vehicle model
CAPACITIVE SENSOR	YES	±0.5-3%	MODERATE	YES	• Requires installation and calibration
STANDARD INJECTOR SENSOR (CAN)	NO	±15%	VERY DIFFICULT	NO	• Requires regular maintenance due to frequent clogging • Complicated installation • Proprietary for each vehicle model
ULTRASONIC SENSOR	YES	±2-3%	DIFFICULT	YES	• Highest cost • Very sensitive to fuel impurities • Difficult installation

*Frost & Sullivan, Future of Logistics, 13 September 2016
**Fleet Answers, Telematics Survey: Industry Insights in 2017, Fall 2017
***Frost & Sullivan, Future of Logistics, 13 September 2016

CAN bus injector sensor

Advantages:

- Delivers information in real time. Easy to connect.

Disadvantages:

- Does not measure fuel level; cannot recognize draining and refueling.
- Only reliable in new or near-new vehicles traveling along good-quality roads over flat terrain.
- Steady traffic speed enables accuracy. Complex driving conditions cause errors to accumulate.
- Accuracy is undermined by driving style, fuel equipment and injection nozzle quality, fuel line and atmospheric pressure, air strainer quality and fuel viscosity.

CAN bus floating sensor

Advantages:

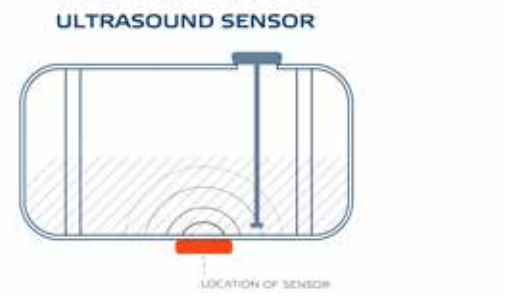
- Indicates when it is time to refuel. Easy to connect.

Disadvantages:

- Blind zones representing up to 10% of volume at the top and a further 10% at the bottom of the fuel tank, causing inaccuracy of up to 20%.
- Requires calibration of tank to get information in liters.
- Variable resistor can suffer damage that makes it lose contact, distorting the signal.
- Variable resistor has just 30 divisions, so accuracy cannot be better than ±3% of the total volume. For instance, in a 700-liter tank the value of one division will be ±21 liters.

Ultrasound non-invasive sensor

Measures the time it takes for an acoustic wave to travel from the bottom of the tank to the surface of the fuel and back. Attached externally underneath the fuel tank.



Advantages:

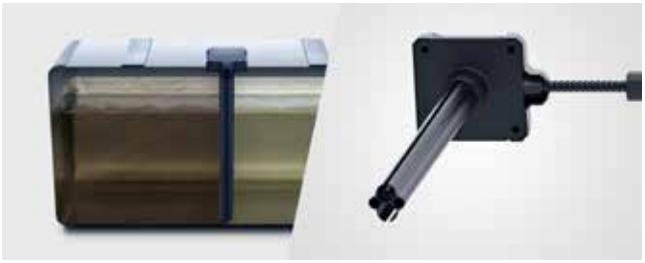
- Attached with acoustic glue; no need to drill or deform the fuel tank.

Disadvantages:

- Complicated installation; difficult to locate perfect spot to attach sensor.
- Glue takes 24 hours to set in a stable warm environment under constant pressure; glue may deform, weakening link between sensor and tank and leading to wave signal distortions.
- Can be dislodged by stones, water, sidewalk edges or deliberate interference.
- Signal gets lost on bumpy or steep roads; hard to aggregate trustworthy data.
- Sand and dirt on tank can make measurement impossible.

Capacitive sensors

The most popular fuel level control technology in the world. Originally introduced for the aviation industry, but now widely used across cargo and freight services, logistics, oil and gas, mining, construction and agriculture. These sensors measure the capacity of the coaxial-type probe condenser as it is filled with fuel.



Advantages:

- Extremely reliable. No blind zones. Highly accurate.
- No mechanical parts to break; no need for maintenance over the sensor's lifetime.
- Forwards real-time data on fuel levels, including information on refueling and draining events.

Disadvantages:

- Capacitive sensors are usually only accurate in relation to the fuel originally used for calibration. Switching fuel types requires recalibration.
- Installation in a fuel tank may void the tank warranty - but this does not affect the warranty on any other part of the vehicle.

However, the newest generation of capacitive sensors feature auto-adjusting technology to eliminate the recalibration issue due to fuel type or fuel chemical composition changes, and claim exceptional accuracy of 99.5%.

Choosing a fuel management solution is an important decision, and you should not invest in solutions that give you incomplete, inaccurate or unnecessary data.

Pick the solution that delivers top accuracy and that you can rely on in the widest possible range of conditions. Inefficient technology will not help you increase efficiency in your business and may even lead to further costs.

Do your research, and choose wisely! ❑

AUTHOR

Mohit Mehrotra, Managing Director of OMNICOMM India- global leader in IoT fuel monitoring and analytics for commercial fleets, transportation, logistics, construction and more.

ELECTRIC VEHICLE BATTERY MANAGEMENT SYSTEM AND CHARGERS

KIRITKUMAR PANCHAL
TESSOLVE SEMICONDUCTOR PVT LTD.

Introduction

The electronics content has been steadily increasing over the last two decades in the automotive segment. The existing market of Integrated Circuit (IC) is not just limited to advanced driver-assistance systems (ADAS), Infotainment & telematics, Chassis & Safety, Powertrain or Convenience, but also the hybrid and fully electric vehicles (EV) market are gaining momentum. The present worldwide automotive semiconductor market is about $38B in 2019, and the market may grow to $75B in the next 10 years considering 7% CAGR.

Today the size of the EV market is less than 3 % of the total light vehicle market. According to one study, there may be about 120M EV by 2030 in the USA, Europe, and China. The average semiconductor content in the EV may increase by about 90% from the internal combustion engine (ICE) cars. The automotive electric vehicle infrastructure market could be about $25B in the next five years. The important building blocks of EV are chargers and Battery management system (BMS).

EV Chargers

The challenge that the EV faces is the battery charging time and battery life. Comparatively, the petroleum-based vehicles take less time to refuel the vehicle as compared to the EV. The level 1 charger has a charging capacity of less than 5KW, the fast-chargers have charging capacity between 5-50KW, and the super-chargers have a capacity of greater than 50KW. The higher capacity chargers take less time to charge the EV battery but it gets very costly and takes much area. The large battery capacity gives more driving range, but it comes with the increase in EV cost.

There are some issues related to faster charging. The fast charging may heat the series resistance of the battery and that may lead to fire hazard. Also, the fast charging may reduce the life of the battery if the battery temperature is not controlled in the desired range.

There are broadly two types of chargers designs available in the market: AC charger and DC chargers. There is a lot of research that is happening on the inductive charging. The AC chargers or the onboard chargers take the input AC supply and convert it into DC supply voltage to charge the battery. While the DC fast chargers deliver DC power directly to charge the battery. The level-3 fast charger may use a three-phase AC supply to convert into DC voltage. Both AC, as well as DC chargers, use a DC-DC converter to convert it into a suitable voltage to charge the battery safely. The theory behind AC/DC charger is similar to the primary flyback converter where the current in the primary is controlled to set the output DC voltage with desired load (battery) current. Both the output feedback voltage and the load current is used in the control loop to stabilize the output voltage. Presently, many IC design houses design use sophisticated digital control to process feedback signals to control the power device.

To reduce the charging time, there can be an intermediate storage entity to store the DC charge instantly before the charge can be transferred to the battery through the charger. This transfer of charge from the intermediate storage space to the battery can be done at a slower speed. It can solve the issue of charging time and battery life.

Battery Management System

The Battery Management System fundamentally takes care of two parameters: 1) accurately sensing voltage and currents of the cells. 2) Battery thermal management system. The first part senses the voltage and current of each cell of the battery pack and then systematically transfers the information to the processor. The processor then compares it with the reference voltage and controls the gate of the power device during the charging operation. The processor also takes care of the safety operations of the battery like over-voltage, over current, short circuit current, over-temperature, and many more protections. It is critical to keep the temperature of the battery in the specified range else it may destroy the battery cells and significantly reduces the battery life.

The digital part of the ASIC may be designed in lower geometry. According to one of the reports, NXP and TSMC are collaborating on their next-generation automotive processor design in the 5nm TSMC process. The high voltage switching is usually done using discrete devices. Super Junction MOSFET can be used for switching up to 1kv and lower power. IGBT can be used up to 3kv and few megawatts of power. Thyristors can handle more power than IGBT.

Reference:

1) AdvancedElectricVehicleFast-ChargingTechnologies, (May 2019, Energies, MDPI) Ryan Collin, Yu Miao , Alex Yokochi , Prasad Enjeti and Annette von Jouanne
2) Charging ahead: electric- vehicle infrastructure demand, Oct 2018, McKinsey & Company
3) NXP Selects TSMC 5nm Process for Next Generation High Performance Automotive Platform, June 2020. ❑

AUTHOR

KIRITKUMAR PANCHAL
Senior Manager
Tessolve Semiconductor Pvt Ltd.

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WHAT WE DO?

- Accurate Fault Diagnostics
- Repair Strategies
- Fuel Pilferage Detection
- Driver Behaviour Monitoring
- Fleet Utilisation & Benchmarking
- Reduce Maintenance Cost
- Improve Vehicle Safety
- Reduce Accident Incidences
- Reduce Operational Losses
- Increase Asset Life And Bottom Line

KEY COMPONENTS ANALYZED IN DIGITAL TWIN ENVIRONMENT

- Electrical Systems
- Turbocharger
- Engine Control Unit
- Power Generation Unit
- Transmission /Gearbox
- IC Engine /Electric Powertrain

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CONVERSATIONAL AI-DESIGN CONSIDERATIONS

BISWAJIT BISWAS
TATA ELXSI

Introduction

Conversation bot design is the most happening thing when it comes to AI computing and an essential thing to consider for making products smart and digitally inclusive. With the rapid progress in AI and specifically in NLP computing, language interpretation has improved considerably making a near-normal conversation possible since the time Siri was first introduced in iPhone 4s in 2011.

Today we see, chatbots have proliferated as part of the web application extension. In fact, adding a voice or chat interface is the fastest way to qualify an application AI-ready, the chatbot also is the strategy for the mobile-first digital economy.

Some of the well-known use cases where AI-powered conversational bots have vastly improved the user experience are into following:

Pre-sales bots: Conversational bots which can help or guide a prospective customer to make a purchase decision, can convert a window shopper into a buyer are in great use. Many customers have inhibition to interact with a real human but may find it perfectly normal to interact with a bot.

Co-pilot: In-car voice assistants are already in great use. They help reducing driver distraction by assisting in non-critical driving tasks, for example, cabin comfort control, infotainment, navigation assist.

Voice-assisted- maintenance: A voice bot is a great help for technicians on the shop-floor which can guide them step by step to deal with a fault repair which otherwise takes referring to user guides, manuals, and technical drawings.

Virtual doctor: A robot health care assistant can converse with the patient for the first level interaction and guide to the next step to Doctor has been in the use already. During the recent pandemic time of Covid-19, this has been put to great use to isolate suspecting patients with symptoms at the same time enforcing social distance.

Conversational AI – Technical background and recent advances

To build an intelligent Conversational Agent, understanding user intent is a key. There are many parts to this challenge, too many variables to solve. Human comprehension of language is complex, and not everything of it is verbal. As a human listener, we also consider many things like the speaker's facial expressions, hand, and body movement, which is also called 'body language' that is unfortunately not under the purview of the NLP computing domain. Language understanding has following key parts and each of them needs to be solved separately to figure out the holy grail:

- Understanding semantics (lexical)
- Understanding syntax
- Understanding context (both short and long term)

There have been several shallow and deep learning techniques that have been very successful to solve some of the language understanding problems. If we were to pick up three most important advancement, which has leapfrogged the NLP success, those would be:

- Word embedding
- Recurrent Neural Networks or RNN
- Attention

Word embedding: In a typical dictionary of any language, words are arranged alphabetically or in some order which doesn't

preserve any semantic proximity or closeness of their meaning. Word embedding is an intelligent way to give unique code to each word in the vocabulary so that synonyms have similar codes, antonyms will be in opposition, and so on. If the words are then represented in this code space, they will distinctly show a pattern according to their meaning. This is going to be extremely useful in language processing.

RNN: RNN is a special type of neural network which unlike convolution networks, is constructed specially to process chains of sequences. This is particularly suitable for language processing because all languages have a sequence of words, expressions, and phonemes. RNN has many variations that help in doing multiple things in language processing like a sentence to sentence translation, sentiment analysis, auto-complete sentences, and so on.

Attention: Attention is an improvement done on part of RNN networks which allows retaining the focus in a long chain of sequences. This, in turn, helps to solve the context part of the problem we deal with in any conversation flow.

Using these techniques there have been several improvements in constructing a neural network for an end to end language processing, they are called Transformers.

BERT, GPT, ERNIE are all transformer-based models from Google, OpenAI, and Baidu respectively. They come packed with pre-trained, trained with the corpus of wide datasets. There are domain-specific models as well, for example – SciBERT – model for scientific papers or BioBERT for understanding biomedical language.

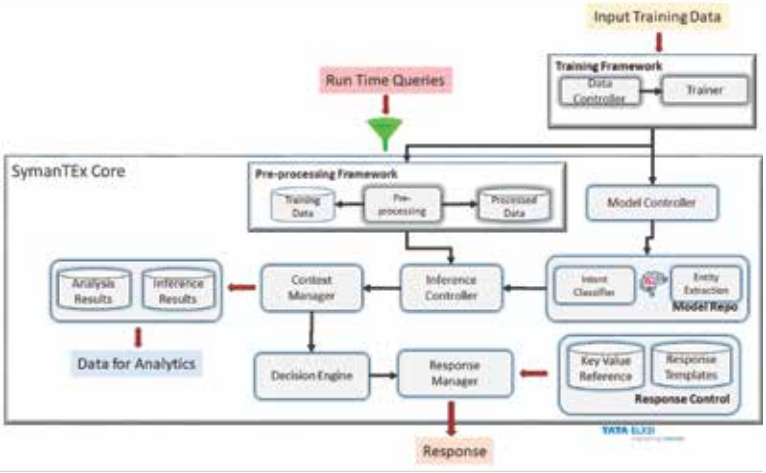
These pre-trained models can be further customized for more specific usage in conversational bots.

Conversational Bot design

As we discussed earlier conversational bot design needs to handle several aspects like detecting intent, understanding short term and long term context, generating a response, handling emotion, speech synthesis. In voice-based conversation things get more complex when the design needs to handle dialect, the context of other filler words like (yum, yaa, uff), pronunciation mistakes. There are modules and submodules to handle each of these aspect of conversation mentioned above and if they are used in the proper sequence and right place, we can have a great conversation engine designed. Response generation is one such key block in a conversation engine that generates the most appropriate response considering the immediate history of the conversation. This module in a sense plays the most vital role in keeping the conversation engaged and leads to a successful closure, without sounding annoying and repetitive.

Conclusion

Designing a Conversational AI system is not an open and shut process, rather it is a continuous journey. As we see in any natural system, more so in a conversational setup, relationships evolve, new things are learned. This necessitates the system to be designed in a way there is always self-learning happening. New keywords are coined, new topics are learned, a new way of saying things, following the trending topic of the day or time. Pepping up the conversation with such titbits helps to keep the conversation feel more real and more human-like.



Conversational AI is going to be everywhere, if not already, in our home, car, banks, shops, and hospitals, driving up a business opportunity of $15 billion by 2024. A lot of these rides on how successful we are as AI designers to make the conversation experience very real using the right choice of tools and techniques, and passion for perfection.

Tata Elxsi has developed a Conversational engine which uses a Lego block concept for its various components. Using these building blocks we can develop a voice or chat-based conversation for any given context. For now, this has been used to develop bots for Retail Sales, Call steering in a call center, Q&A bot, Voice-based attendance system, and so on. ❑

AUTHOR

BISWAJIT BISWAS
Chief Data Scientist
Tata Elxsi

HMI: THE NERVE CENTRE OF AUTOMOBILE

SUDEEP NARAYAN
VOLVO CAR INDIA

It is not the engine size or the horsepower anymore that makes customers decide brands of automobiles. Then one must wonder if it is the music system? Or airbags? In some parts of India either of these could shift the preference. There is another 'New-Norm' catching the imagination of customers and automobile manufacturers alike. Welcome to the Digital Era of Human-Machine-Interface (HMI).

One of the first HMI we used as humans was the TV remote….. Phew that was magic and the remote continues to create that magic in every home. A lot has been said about HMI and yet much more needs to be explored. Let's take a step back and understand the role of HMI in the automotive industry. It stems from a fact that societal behaviours have changed and we want digital intrusion virtually in all aspects of our lives for at least 16 hours a day (the rest 8 hours we are supposed to sleep). In my opinion, a good HMI should cover these basic aspects:

- **Design:** It should be a simple easy-to-use experience. Ergonomically designed for a better UX. For example the tiles for each functionality should be big and across a portrait orientation as opposed to landscape. 90% of cars have a landscape orientation, this would mean wider movement of hand while driving. While driving the most important tab is researched as the navigation tab and that should be at the top.

- **Interactivity:** At present the touch is the most used interactivity, voice control is taking over the interaction at break-neck speeds and there was also the gesture control which in my view does not work.
- **Safety:** HMIs need to be least distractive in order for the driver to be alert always.
- **Convergence:** There is a long way to go in this area for HMI hardware. A simple thing like a google map is not yet integrated in the HMI of many cars. We are seeing this happening very recently and that is a good step.

HMI will gain even more significance if the Connected, Autonomous, Electric and Shared Mobility converge in the near future. The challenge for developers would be to keep it simple and adaptable to any Operating System. There are challenges in using Whatsapp in Android vs iOS as they are not identical interfaces (by Identical I also mean the colour scheme). This is particularly important for Shared Mobility.

If one has to crystal ball gaze, there are some emerging trends that make the user's digital interface seamless. Currently the HMI is very specific to the automobile but in this world of running against time the Automobile Interface has the potential to perform a host of features:

1. Car to Manufacturer's services:
   a. **Book a service automatically:** This is a convenient service that the owner does not have to worry about and the car books service with the owners preferred dealer and pre-fed day of the week and time. A step higher could be emailing the diagnostics of the car to the service station for faster assessment.
   b. **Horsepower for the hilly drive:** It is possible to download horsepower through the HMI connecting it with the manufacturer's mainframe by recalibrating the ECM chip remotely.

c. **Exchange offer:** How about the HMI sending vehicle history to the dealer or a used car dealer for selling the car and buying an upgraded version once the car reaches the mileage or age as inputted.

2. **Emergency Services:** The HMI can be used as a hardware for automatic emergency services of notifying the ambulance and fire brigade if the airbag has deployed. The critical minutes could save lives.
3. **Location-based Services:** This is self-explanatory and can include, refuelling, restaurants among other interests.
4. **In-car delivery:** While the convenience of app based delivery services are integral in our lives, it also means we have to be home to accept it. The car is a great place for accepting delivery as it provides the owner the bandwidth. Volvo Cars in US tied-up with Amazon Delivery for such a service. The delivery person has a digital key that can open the boot, place the consignment safely in the car, close the boot closed and a notification goes to the owner.
5. **Car-to-Car Communication:** There is another service Volvo Cars have introduced in Europe – Slippery Road Conditions. If a Volvo passes an icy/slippery patch of road the HMI collects the data from the wheels traction and sends it to a cloud based domain for other cars to be alerted well in advance.

As I mentioned earlier, a lot has been done but the future possibilities are endless. A trend that I forecast in the near future would be that HMIs will become standard and automobile companies would offer, an example - Android based system or an Apple based system to customers. I foresee this for a specific reason of standardisation in a connected world and there could be a time when customers could choose brands of cars based on the experience of its Human-Machine-Interface. ❑

AUTHOR

Sudeep Narayan has a vast experience in Advertising and Automotive marketing. Currently Director – Corporate Communications with Volvo Car India, he has executed successful campaign for the company over the last 12 years. Prior to Volvo he was with General Motors and before that a successful stint in Advertising with top companies that include McCann, Leo Burnett and Enterprise Nexus.

Vulnerable Users Vehicle Sensing Detection Methods

SATISH ULLATIL
LEAMENG SOLUTIONS

Pedestrians are particularly at risk in traffic. In most accidents, the pedestrian collides with the front of the vehicle The requirement of Pedestrian detection is an essential and significant task in any intelligent video surveillance system, as it provides the fundamental information for semantic understanding of the video footage. It has an obvious extension to automotive applications due to the potential for improving safety systems. Product OEMs have developed an electronic system for active impact protection for pedestrians which is a safe and cost-effective solution and also fulfil the legal requirements for pedestrian protection on vehicles and predictive pedestrian protection system which can detect impending accidents with pedestrians who are in the same lane as the vehicle or who are moving dangerously into this direction.

Pedestrian Safety Methods

There are few safety methods being introduced by leading OEM manufactures such as Continental and Bosch

1. Intelligent Crash sensor.
2. Pressure based system.
3. Pedestrian Sensing & Detection.
4. Video based approach.
5. Active Sensor approach.
6. Radar based approach.
7. Laser.
8. Lidar.

Intelligent Crash Sensor

The intelligent crash sensors are complement to the speed airbag control unit in a crash. They are based on robust technology and acceleration satellites. The compact sensors are concealed in the bumper which sends a signal to the speed control unit when a collision occurs. The control unit can then raise the hood in a matter of milliseconds, creating a deeper crumple zone that prevents the pedestrian's head from hitting the engine block and reduces the fatal injury. The acceleration-based pedestrian protection system can be enhanced by combining with pressure-based technology.

Fig1: Crash Sensor

The sensor provides protection for frontal and side impacts as well as from pedestrian protection which supply information on the acceleration values in the rigid vehicle structures in the event of a crash. They are used in conjunction with the pressure satellite, acceleration satellites offer an optimum solution for the rapid discrimination of side impacts. When the two technologies interact with each other, a synergetic value is obtained. In a crash, the pSAT immediately senses any pressure change in the door, and the gSAT then measures the lateral acceleration. With this fast, precise information, the airbag control unit can activate the side airbags in just a few milliseconds.

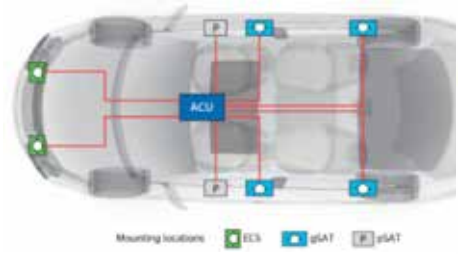


Fig2: Sensor Mou nting Locations

Pressure Based System

The pedestrian protection sensor consists of a flexible air tube that is laid across the entire width of the car in its front bumper.

The pedestrian protection sensor consists of a flexible air tube that is laid across the entire width of the car in its front bumper. The tube is situated directly behind the foam block that is fitted at the front of the vehicle to absorb impact energy. Standardized pressure sensors (pSAT) are installed at either end of the air-filled pressure tube. When a vehicle collides with an obstacle, the resulting pressure exerted on the tube through the front bumper and foam block creates a typical waveform that is detected by the two sensors at the ends of the tube and forwarded to the speed airbag control unit.

Fig3: Sensor Mounting Locations

Example on above image the front right-hand corner or the middle of the vehicle. Within 10-15 milliseconds of an impact, the active hood of the vehicle is triggered and raised by special actuators. This reduces the risk of death or severe injury to the pedestrian from hitting the hood and underlying engine block. The sensor is easily adaptable to any vehicle type. The pressure-based pedestrian protection system can be enhanced by combining with acceleration-based technology (gSAT).

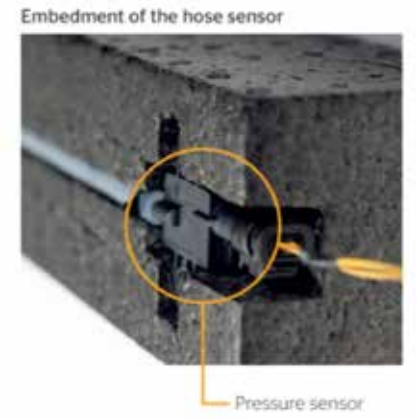


Fig4: Pressure sensor location

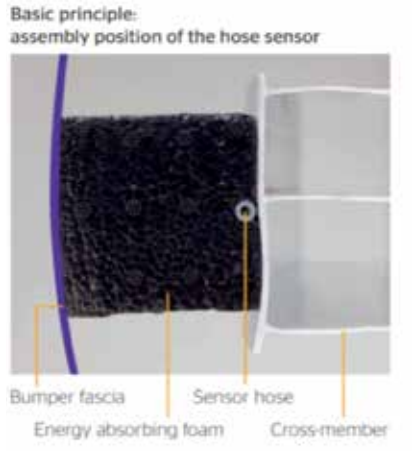


Fig5: Pressure sensor location in Bumper

Pedestrian protection is gaining more and more attention due to new legislation requirements and tougher consumer ratings. This is leading to the introduction of pedestrian protection systems, like active hood lifting. For triggering these actuators a reliable sensing system is required. Within 10 –15 milliseconds of an impact, the active hood of the vehicle or window airbag is triggered. This reduces the risk of death or severe injury to the pedestrian from hitting the hood and underlying engine block.

Fig5: Pressure-based pedestrian protection

Pedestrian sensing & Detection

Based on a research article, a new working principle in car technology today is the pedestrian sensing and protection system. This system will be able to automatically detect when a person is walking in front of your vehicle within a close distance. For example, let's say you're driving through an intersection and a person is walking across the street in front of you. If you aren't paying attention to the road or if you turn your head away for just a few seconds, then you might not see them walking. This could result in you hitting them with your vehicle. However, with the pedestrian sensing and protection system, the car's sensors will detect that the person is close by and then automatically apply the emergency brake to stop the vehicle. The driver does not have to do anything.

1. Sensors – The car will know when someone is walking in front of your vehicle. If they are less than 10 feet away, the emergency brake will be applied to stop the vehicle from hitting them.

2. Video Camera – Some versions of this system will utilize video camera technology to detect a person in front of your vehicle. It will be able to recognize the distance and movement of the person

instantly and then apply the brake when the vehicle gets too close.

3.Automatic Braking – Up until now, you would have to slam on your brakes when you notice someone passing in front of your car. If your reaction time isn't fast enough, you will still end up hitting the person anyway. The automatic braking of this protection system will ensure that the brakes are applied at the earliest time possible in order to avoid hitting the person.

Pedestrian detection

The pedestrian detection uses advanced sensors to detect human movements; some versions may urgently apply the brakes if the driver fails to respond. The system alerts the driver or automatically brakes if there is a pedestrian in the path between a certain speed range—generally around 25 mph. The advanced sensors used to detect human movements ahead and alert the driver. Some may automatically apply the brakes.

Technology behind the Pedestrian detection technology:

Stereoscopic cameras mounted behind the rear-view mirror and radar have become effective at detecting the more subtle movements of people.

These systems are more effective at slower speeds. Pedestrian Detection may not always be able to help avoid a collision, but this feature can help reduce the speed enough to make the impact more survivable. As research progresses, infrared technology is being added to improve performance, especially at night.

Fig7: Stereoscopic camera

Video based approach

Based on Alberto Broggi [5] University of Pavia, Italy review that video sensors are a natural choice for detecting people. Texture information at a fine angular resolution enables quite discriminative pattern recognition techniques. The human visual-perception system is perhaps the best example of how well such sensors might perform, if we add the appropriate processing. Besides, video cameras are cheap, and because they do not emit any signals, they raise no issues regarding interference with the environment. Considerable computer vision research deals with "looking at people." What makes pedestrian recognition applications on vehicles particularly challenging is the moving camera, the wide range of possible pedestrians.

Active Sensor approach

Active sensors do not directly provide depth information; stereo vision derives depth by establishing feature correspondence and performing triangulation. On the other hand, active sensors measure distances directly

Radar based approach

Some commercial vehicles already employ radar for adaptive cruise control (for example, the Distronic System on Mercedes Benz S-Class cars). For near-distance applications, such as pedestrian detection, ongoing investigations focus on 24-GHz radar technology.14 Radar-based systems can enhance object localization by placing multiple sensors on the vehicle's relevant parts and applying triangulation-based techniques. They can classify objects—that is, distinguish pedestrians from other objects such as cars and trees—by examining the power spectral-density plot of the reflected signals. In this context, we consider an object's spectral content and reflectivity. Objects with smaller spatial extents, such as pedestrians, have narrower peaks in the plot than, say, cars. The material properties of the object's surface determine the strength of reflected radar signals. Vehicles metallic parts reflect much better than human tissue, by at least an order of magnitude. Human tissue, in turn, reflects much better than non-conductive materials, such as the wood in trees.

Laser

The main appeal of eye-safe laser range finders lies in their fast, precise depth measurement and their large field of view. For example, Martin Kunert, Ulrich Lages describe a laser range finder that has a depth accuracy of +/− 5 cm and a range of 40m for objects with at least 5 percent reflectivity (this includes most, if not all, relevant targets). Furthermore, its horizontal scanscover a 180-degree field of view in increments of 0.5 degree at 20 Hz, making the sensor especially suitable to cover the area just in front of the vehicle.

LiDAR

LiDAR uses scanning lasers to measure distances to surfaces, producing a three-dimensional map of detailed shapes. LiDAR is capable of object detection in low/no-light conditions, but like VLC, is unreliable in adverse weather and when road surfaces are wet or reflective. LiDAR is potentially useful for medium- and long-range detection, but is typically deployed as a single unit on a vehicle's rooftop, with its "view" of the ground surrounding the vehicle obstructed by the vehicle itself, hindering detection at very close range.

Sensors' abilities to detect pedestrians in advance of fatal collisions vary from <30% to >90% of fatalities. Combining sensor technologies offers the greatest potential for eliminating fatalities, but may be unrealistically expensive. Furthermore, whereas initial deployment of automated vehicles will likely be restricted to freeways and select urban areas, non-freeway streets and rural settings account for a substantial share of pedestrian fatalities.

Although technologies are being developed for passenger vehicles to successfully detect pedestrians in advance of most fatal collisions, the current costs and operating conditions of those technologies substantially decrease the potential for passenger vehicles to radically reduce pedestrian fatalities in the short term. ❑

AUTHOR

SATISH ULLATIL
Founder, Technical Consultant & Lead Trainer
Leameng Solutions

The Dawn of E-Power & challenges of electromobility for Car Makers

STEFAN JANCIGA
SYGIC

For more than ten years, the future of electromobility seemed like a distant prospect thanks to the high prices of eCars, their low range, and the near-absence of charging infrastructure or battery research.

Today, we can confidently say that in upcoming decades this industry will change the automotive world as we know it. The question is no longer if, but when and how.

In spite of all the efforts, the global market share of eCars is still just two per cent

Technological progress is mostly focused on improving batteries, charging capacity and speed, or on the affordability of electric vehicles. But carmakers are for the most part ignoring an equally important aspect – the anxiety that most drivers experience at the prospect of switching from internal combustion engines.

Electric vehicles and batteries behave differently in traffic jams, on highways, in cold or hot weather, cannot be instantly refuelled, have different plugs from model to model, and rely on a network of charging stations that is still developing.

All these factors lead drivers to doubt the range and ease of charging of eCars, and may be inhibiting demand.

Infotainment systems seem not to be part of the technological revolution

With some exceptions, most of today's electric cars use the same or only slightly modified software as internal combustion engine cars. This includes navigation and advanced telemetry, which is a crucial part of the solution for tackling range and charging anxiety.

We mean a modular, easy-to-integrate smart driving assistant developed specifically for electric vehicles. It consists of navigation based on individual car profiles and state-of-the-art eRouting, live traffic information and offline maps, charging-service providers and payments integration, and telemetry that provides guidance for eDrivers.

This solution is lightweight and flexible enough to be part of each car's built-in systems, providing drivers with confidence about their range and charging, thereby easing their transition from internal combustion engine vehicles to electric vehicles by addressing these key challenges:

- The different behaviour of electric motors compared to internal combustion engines
- Calculating the actual driving range
- Real-time integration of vehicle data
- Driver behaviour telemetry
- Factors negatively affecting driving range (e.g. weather, battery age, climate, air-conditioning usage)
- An undersized network of charging points
- The variation between charging point providers and specific conditions of use
- Cross-border travel using an international roaming solution
- Various charging modes (AC, DC) and connector types used in the charging points (Chademo, Combined Charging Standard -CCS)
- Variable charging speeds for each charging point, depending on the available electric voltage (230 V – 920 V) and maximum performance of the charging stations (from 2.5 kW up to 350 kW)
- Compatibility of the peak performance capability of the vehicle and the charging station

All of these challenges form a complex problem for electric vehicles that we call range and charging anxiety.

Range and charging anxiety – range drop

Despite the 64 % growth in the number of electric vehicles worldwide in 2018, internal combustion engine cars still make up 97.8 % of global sales. The automotive industry is struggling to take the next step, from innovators to mass acceptance.

There are several factors that negatively influence the range of each electric vehicle. Currently, the route is calculated assuming a fully charged battery and does not take into consideration how the driver actually drives, if they might need to temper their speed, or how fast the compatible charging points en route will be.

Navigation with predictive eRoute planning actively uses real-time information, taking into consideration several variables:

- Weather (current, forecast)
- Road topology (elevation)
- Traffic
- Driving style
- Historical data
- Charging speed
- Driver behaviour
- Driving style

Internal combustion engines are most fuel-efficient at higher speeds – up to 90 kilometres per hour (55 mph). Electric motors achieve the best results at speeds lower than 70 kilometres per hour (40 mph).

From the routing perspective, this means that if a driver navigates from point A to point B with a higher average speed, they might need to make at least a one-hour stop to fully recharge.

By avoiding highways and going via a slightly longer route at an average speed of 70 kilometres per hour (40 mph) it might, conversely, be possible to skip the charging stop and arrive directly at the destination.

For internal combustion engines, the first route will be the most time-efficient. For electric vehicles, even at the cost of more kilometres driven, the most efficient will be the second. ❑

AUTHOR

Stefan Janciga, Vice President of Automotive Business Unit, Sygic. Sygicis a global navigation vendor, trusted by more than 200-million drivers around the world.

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Email : sales@itriangle.in

Brewing Hot in the Automotive World: In-Car Payments

ABHIJAY SISODIA, CISCO
ABHINAV KUMAR, AIRTEL

Mobile payment has truly been a boon for the world economy. It has successfully uprooted the traditional wave of over the counter transactions and ushered us into an era of couple-taps-on-your mobile transactions.

This is exactly the era when the latest in tech greeted the backbone of every economy, the financial institutions, with a big bouquet of innovations and a coronet with Fin-tech inscribed on it.

While the foundation for this was laid in the 90s, it's taken us about a decade and a half to accept the new suave of transactions. Today, we are surrounded by a big pool of mobile payment wallets and every phone is incomplete without at least one of these apps. But getting to this point hasn't been easy at all, ask any fin-tech startup.

> **"IN-CAR PAYMENTS IS COMING UP FAST, THERE IS NEED TO CONTINUOUSLY GAUGE SECURITY CONCERNS; ITS MONEY WE ARE DEALING WITH."**

In the process, these companies have burnt billions of dollars just getting users to adopt a new mindset of commerce. If your mind races to the golden word Cashbacks when you read this, the money spent by these companies offering them was worth it.

Are you someone who kept a track of cashback deals offered by mobile wallet companies? Did you win free carbohydrates in the form of pizzas, desserts and coke?

Did you get to travel with a complete stranger in a cab @49 only for almost 6 months?

Well, kudos, good for you. While many experts labeled these cashback strategies as suicidal, investors' nightmare and market dampeners, they forget one key upside to using them, the rapid user adoption.

It's no longer a debate that e-commerce is our present and more innovation resulting in a more automated shopping experience is where we are headed.

Do you shop using e-commerce websites? Regardless of your Yes or No, the ecommerce users are growing globally and by 2025 every 3 out of 5 people will be shopping online. The ecommerce businesses accelerated by a wider adoption of digital technologies, mobile phone and ecommerce apps. E-commerce adoption is supported by secure and reliable connectivity over cellular Wi-Fi networks. In the next few years, the same technology enablers will be a standard and inseparable part of your connected car.

Now that we are used to paying for everything from a single screen, automotive OEMs want to build on this huge advantage and offer users the chance to pay digitally but from a different screen, the one embedded in your car. Yes, we are referring to the infotainment system.

Connected cars are enabling a mode of e-commerce and payments. Initially, we started using e-commerce to buy products as the platform provided more variety, better price, ease of use while sitting on sofa, shop at any time and a trust on product reliability. Interestingly, over the last few years another trend that has gained pace is subscribing to service. We were used to paying for only public utility services electricity gas water, waste water, garbage collection and broadband. In recent years there has been addition to these services like entertainment (Netflix, Disney, HBO, Apple TV), and more products are now bought as service like ADT security, Nest thermostat and most of the software are subscribed SaaS.

It is estimated that household in United States are now subscribing to an average 5 content services. Connected car service from automotive OEMs is another addition to our subscriptions.

Let's look at the top use cases for in-car payments which have been rolled out in different vehicle segments:

1. Alliances with Gas and Electric Charging Stations — Some Car OEMs have already added an app to the vehicle dashboard in partnership with gas and e-charging stations that allows customers to select and pay for their fuel or charge from their vehicle dashboard. The biggest

advantage of having this experience is not only that it saves customers from swiping their card or navigating through menus at gas station terminals, but the vehicle knows exactly how much fuel it needs.

Going a step further into the highly anticipated truly driver-less future, the vehicle itself will be able to complete the trip to the gas or charging station while you are running an errand or eating lunch. Now, who would not want such a responsible car?

2. Pay for Food — A connected car has the promise to not keep you waiting in the alley for food, no chance. So far in connected cars, we have seen that you can order your food from a selected food joint and collect it from the drive through. By the time you arrive, it's usually ready and then you take out your wallet to pay for it. Not anymore. In 2016, MasterCard partnered with General Motors and IBM to integrate payments into OnStar Go, an AI-powered version of the system. This meant that using your OnStar subscription, you can now also pay for food and drinks from the car dashboard. It's a one hundred percent integrated experience. Select the meal, pay for it right there using your credit card.

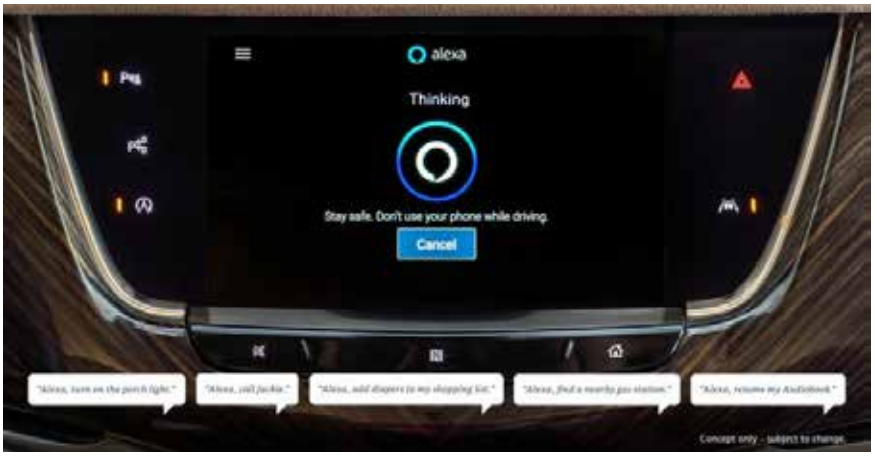
Again, just to give you a glimpse of what lies ahead, your autonomous vehicle will pick up pre-ordered groceries, meals while you are finishing up your work day and the car would meet you as you walk out your office door. In case you're wondering, no, Seinfeld didn't predict this.

3. Buy or renew Insurance — The Insurance sector is going through an extremely innovative phase as well. For motor insurance, there is UBI (Usage Based Insurance) which means the insurance company would make use of the telematics data collected from a connected car and calculate discounts or premiums based on that data. Basically, be prepared to have a registered driver's report card wherein your driver behavior would be captured. Now, we will cover this exclusively in a different blog post, so don't jump into conclusions yet. A lot of OEMs have added the option to renew your annual car insurance from the connected car app itself. But over time, they have just gone a step further and integrated the option to renew insurance from the car dashboard itself. OEMs are hell bent on giving you everything on that one screen and keep you away from your phone as long as you are behind the wheels.

4. Book your parking spot — This isn't as simple as it sounds, trust me. Select a free parking spot from the car dashboard, book it for a fixed duration, and pay in advance for it from the car, voila. There is another way to do this. Visa and Honda have been working in collaboration with smart parking meter manufacturers and have demonstrated a new in-vehicle payments system. Honda drivers will be alerted when they pull up to a beacon-equipped smart meter, and they can pay just by touching a button on the dash. As we witness more and more work being done in US and Europe to increase adoption of this use case, countries which really need this system like India and China, have parked it for the future.

5. Renew those Subscriptions — Subscriptions are the new buzzword. Every new business today is somehow thinking about a subscription based model, especially the manufacturers. We are about to enter a phase of life where we won't even remember the count of subscriptions we pay for. Take a moment. You can categorize them into content (Netflix, Amazon Prime, Spotify, FT), Food & Groceries (Amazon, Zomato), Shopping (Amazon, Just Fab, Krate), Health & Wellness (Bombay & Cedar, MindWander), Dating (Tinder, Bumble) etc. Now, this is where the auto OEMs plan to piggyback on the popularity of subscription based models and cut themselves that additional slice of revenue. Apart from renewing telematics subscriptions offered by the OEMs from the dashboard itself, they will offer renewing various other subscriptions that you may or may not have subscribed for.

6. Cruise through tolls — While there are partnerships being forged between financial companies like Visa and MasterCard, automotive OEMs and



ecosystem institutions like gas stations and parking meter companies, we believe that paying for national tolls through the car dashboard will be a by-product of such tie-ups. For example, Visa has partnered with Toll services in various countries. It wouldn't take them much time to enable in-car automatic toll payments for multiple OEMs as they continue to on-board them.

7. From Add to cart to Checkout — While some OEMs already allow adding items to cart from the car dashboard, with the integration of payments, on the spot checkout isn't too far as well. Let's see what Ford is doing additionally to enhance the shopping experience of their customers.

Ford Motor was one of the first car manufacturers to add Amazon's Alexa digital voice assistant to its vehicles. The first phase of its Alexa integration would allow users to connect to their cars from inside their houses to their Amazon Echo, Echo Dot and Amazon Tap devices. You can start your car's engine, check the fuel level, lock or unlock the doors and even gauge the battery life just by chatting with Alexa. While this sounds awesome, they have gone ahead and allowed users to talk to Alexa from inside their cars, enabling them to edit their shopping lists and even buy stuff while driving. Drivers will be able to order any item available via Amazon Prime in their Alexa-equipped cars, and the voice assistant will even make product recommendations based on order history.

While these were the top use cases we have observed for in-car payments which are either being launched or in the works, let's also look at some other trends which are evolving rapidly in this space.

In-car voice-assisted shopping is gaining some serious momentum, thanks to the tech giants — Apple, Amazon, Google, Microsoft. Imagine using voice commands to order any item and pay for it. While these voice assistants sound cool and Genie like, granting you your wishes, they are not as simple to work with. As it often happens with navigation and other voice commands in the car, not understanding or wrongfully translating your voice command could cause some serious damage. It can potentially add some distraction and frustration, maybe even a lead to a new form of road rage, as if we don't have enough reasons already.

To plan around these issues, auto makers and system manufacturers must consider the entire customer journey from determining what to buy, researching options, checking inventory, and ultimately adding products and services to cart and payment functions when designing UX/UI solutions.

What started with the integration of voice-command applications like Alexa and Siri for navigation assistance and infotainment, car manufacturers have shifted their entire focus to delivering direct-to-consumer mobility services and unified experiences along the entire customer journey and some of them are even building their own in-house voice assistants. The next couple years could see some very exciting and innovative in-car payment propositions come up.

Another very interesting concept being worked upon is the use of blockchain in vehicles. Though these are still early days, a lot of thought has already gone into building proof of concepts. Let's look at an early example here. The Blockchain Factory of Daimler Financial Services (DFS) has developed the Mobility Blockchain Platform (MBP) together with four startups, one of them being a blockchain interface startup RIDDLE&CODE. Under this partnership, the blockchain company will provide a hardware car wallet solution, basically a digital wallet, to give the vehicle a network identity that enables it to handle transactions automatically. Daimler's MBP is a decentralized software platform that makes it possible to offer and manage mobility as a service with end-to-end encryption. With initiatives like these hitting the market, a future where your car has its own digital wallet transmitting and storing data and payments over blockchain or distributed ledgers doesn't seem far at all.

While the in-car payments space seems to be taking enormous strides every couple months without throwing any caution to wind, experts have expressed security concerns, after all, its money we are dealing with. These payment systems can be protected with techniques and approaches quite similar to mobile security systems, such as multi-factor authentication, data breach prevention and fraud detection and prevention. So far, such measures are being taken into consideration by all alliances between financial institutions and OEMs. But since malware and fraudulent transactions are also part and parcel of life, you never know when your car wallet starts doling out your money without your approval. Just keep a check, would you. ❑

AUTHORS

ABHIJAY SISODIA
CISCO

ABHINAV KUMAR
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SIGNIFICANT UNREALIZED OPPORTUNITIES WITHIN ADVANCED TELEMATICS

Advantages of OEM OBD Data integrated with dealer DMS

SERGEY NAUMOVSKY
AUTORETAIL.GURU

Telematics and DMS

The lion's share of car service over its lifecycle is performed through the network of franchised car dealers. Therefore it's crucial for OEMs and data vendors to have smooth integration with dealers in order to feed data into established dealer process. For instance – remote diagnostics are best used if they go to CRM (for customer contact) and Service (for repair order initiation). While in US there are three main DMS providers (Reynolds, CDK and DealerTrack), offering certified integrations for vendors into various parts of DMS (sales, service, accounting, etc.), in Europe, and especially in Russia, there is a garden variety of DMS systems, with widely varying API. In order to get the data to dealers, vendors have to rely on third parties or get involved in lengthy integration process.

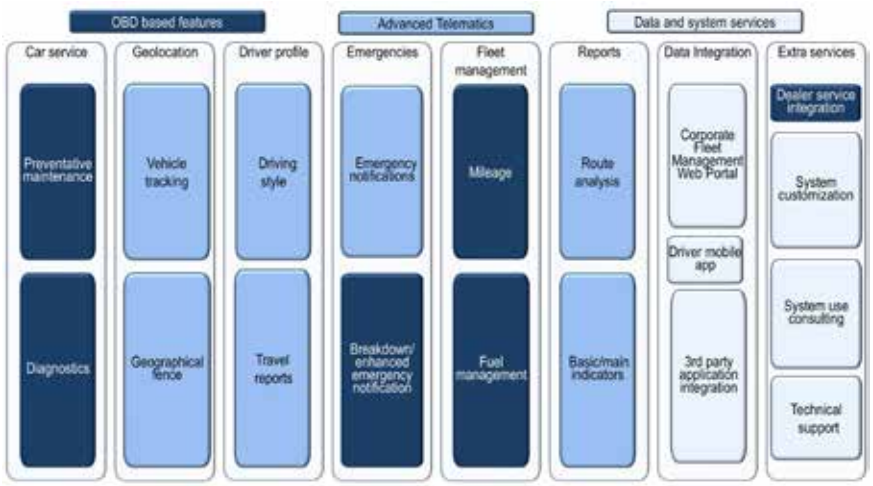
Is understanding of DMS important, when working with OBD?

We think it is absolutely critical! Few years ago one of the largest global suppliers of technology and services to automotive industry came out with a truly advanced remote diagnostics system, available in several form-factors to cover a wide range of applications, from new cars to aftermarket sales. However, the system was offered as white label hardware, assuming car manufacturers would write their own apps and integrate with DMS of their respective franchised dealer networks.

Result?

Despite sincere interest from car manufacturers and their local distributors, the system did not find demand the way it was offered and seems to be no longer available. That solution had every hallmark of a winner and we think it can still gain a significant share of the market, despite the time lost, if revived and offered as a turn-key solution.

What does integration of OBD data to DMS do? It allows creation of customer mobile apps that



include functionality needed for OEM data as well as the dealer/fleet owner -specific requirements.

Additionally, Mobility as a Service (MaaS) can be used to the advantage of OEMs and dealers by making a MaaS friendly car fleet and connecting it to the dealer network as the logical step.

Current State of OEM/ Dealer DMS integrations

Historically, OEMs and major technology suppliers (like providers of advanced car diagnostics, e.g. Bosch, Continental, etc.) had rather limited understanding of internal dealer processes and, especially, dealer DMS systems, which are dealer's bloodline, therefore hindering potential effectiveness of data distribution, making entire process cumbersome and sometimes cost-prohibitive.

There are hundreds of teachings on DMS, and if anyone needs a crash course on it – one can visit the website in reference (1).

There is a complexity of relationships within entangled web of DMS arena between DMS providers, OEMs, dealers, ad-hoc technology suppliers and myriads of integrations. In Reference (2) is an article by President of NADA Peter Welch. The very name of the article relates the situation: "It's Time to Get Our Arms Around the Data Quagmire"

OEM OBD libraries

There are thousands of OBD DTCs (diagnostic trouble codes) in modern cars. Good portion of them are OEM specific. It's expensive to get updated OEM libraries and not many experts really know how to use them. Major technology providers, like Bosch, consider OEM DTCs as their crown jewels.

But surprisingly few OEMs are taking advantage of it so far, while more and more third parties are gaining edge on lucrative advanced Telematics market. What about integrating remote diagnostics with dealer DMS systems (Connected Car with Connected Dealer genuinely completes the equation!) plus creating an external API interface to access pre-packaged features for authorized third parties?

Coincidentally, the same remote diagnostics features would be attractive and can be packaged in mobile apps and other services to retail customers as well.

Picture below shows what kind of advantages can be added to common Telematics solutions by adding OEM OBD libraries.

Advantages that can be provided by OEMs and dealers

Feature	From OBD	Data to	Integration with	Opportunity
Preventive maintenance	**OEM value** - Next service interval in days/next service interval in distance	**DMS**	Dealer	**Allow dealers to capture lucrative scheduled maintenance business**
Diagnostics	Standard DTCs/**OEM DTCs**	**DMS**	Dealer	**Bring service to dealer network**
Breakdown/ enhanced emergency notification	Standard DTCs/**OEM DTCs**	**DMS + API**	Dealer E-call/E-call Plus ERA-GLONASS	**Bring service to dealer network** **Enhance emergency services response - increase safety** **Accident reconstruction - reduce liability**
Mileage	**OEM value** - Vehicle Mileage	**API**	Fleet CRM	**Provide reliable mileage readings (leasing, car sharing, rental)** **Prevent odometer fraud**
Fuel management	**OEM value** - Fuel level in liters/Average fuel consumption	**API**	Fleet CRM	**Prevent fuel theft and unauthorized fueling** **Optimize fuel management**
Dealer service integration	Standard DTCs/**OEM DTCs**	**DMS**	Dealer	**Optimize appointment, pre-order parts, select appropriate mechanic category**

Integrating these features with dealer DMS opens a wide range of new business opportunities for OEMs, dealers and service providers.

Picture below shows just some of them

Universal Data to DMS adapter

While getting data in and out of some DMS systems requires certified integrations, many DMS systems are open, but have various API. There is opportunity for OEMs and major technology suppliers to create a universal data-to-DMS adapter to streamline such integrations. Once such adapter is created, it can be dynamically configured to support additional tasks. Below is an example of how aforesaid adapter can be designed.

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2. https://blog.nada.org/2019/09/17/its-time-to-get-our-arms-around-the-data-quagmire/ .

AUTHOR

Sergey Naumovsky has been involved in automotive industry for about 30 years, working in autoretail and technologies of its automation. Among customers are: Cox Automotive, Bosch GmbH, Mitsubishi Corporation, MC Bank Rus, NP GlONASS and major car dealer groups.

EDGE COMPUTING IN MODERN-DAY CAR

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The automotive industry with connected vehicles is one of the fastest growing industries for Edge Computing. The creation and distribution of advanced maps with real-time data, and advanced driving assistance using analytics of video streams are all examples of emerging services that require vehicles to be able to Compute Intensive. This will require networks that can facilitate the transfer of a large amount of data between vehicles and the cloud where compute happens, often with real-time characteristics. However, given the real time & mission critical needs of Automotive vehicles including tough latency, reliability & security requirements a distributed computing architecture including Edge & Cloud is needed for automotive. Also, many of the functionalities & features inside a Car are rapidly moving to Software & Cars are becoming a Compute Engine with features being offered at a Software level rather than traditional all hardware-based features. Cars are also generating & consuming massive data and offering multiple data-based services to the riders (for example real time traffic monitoring, Vehicle tracking, online infotainment etc.) which is only possible with a distributed computing architecture and a superior connectivity which is becoming reality with 5G coming in.

In summary there are three key disruptions enabling a Car be a more Software driven & thereby having more local computing powered by Edge. They are: -

- **Market Change:** - Automated Driving, Connected Solutions, Reducing Vehicle Life Cycle & thereby having more Software based features to reduce cost & time to Markets quickly, Growth of Smart Cities & thereby increase use of Data (e.g. Smart. Traffic Management), Smart Fleet Management to reduce Operational Cost significantly.
- **Shared Mobility:** - With increasing competition between the shared mobility service providers, Ubers & Lyfts are offering new services to attract & retain their Customer base. This is forcing OEMs to add new features in Cars. For example, purpose-built vehicle could feature lower levels of complexity; less powerful engines; simpler, easier-to-clean interiors; less complicated assembly processes; and lower distribution costs. Such a car could cost almost 25 percent less than a typical vehicle & will make shared mobility more affordable. Similarly, Autonomous Vehicles could be a real game changer for service providers. Today, car sharing is rarely economically viable in cities with fewer than half a million inhabitants. Self-driving cars would enable mobility players to reposition vehicles optimally, allowing smaller fleets to provide adequate coverage and reducing the fixed cost base. Autonomy would also let companies target different user segments via smaller differentiated fleets of vehicles.
- **Complexity Change:** - Instead of Multiple ECUs merge them to a Connected Products which are Automated & Holistic.

In 2013 10% of Car Features were delivered by Software & by 2023 it is expected to go up by 40%. Hardware share is expected to come down to 40% from 85% in 2013. Sensor will go up from 5% in 2013 to 20% in 2023.

Let's look at some of the use cases of Edge in the Modern-day Car: -

- **Sensor fusion and value aggregation:** - Modern Day Car will have hundreds of Sensors in the Car. The data generated by these sensors are locally processed, fused together to give a consolidated view in a Service Oriented Architecture & local decisions are taken inside the Car by Edge Computing. Some of the data needs to be sent to Cloud for further processing where Edge computing helps to limit the amount of data that is pushed out in a smart way. This reduces the data transmission costs and limits the amount of sensitive data leaving the vehicle.
- **Next Generation ECU Architecture & Vehicle Networking:** - In a traditional Car Architecture we have multiple independent ECUs (close to 100) which are interconnected through CAN Bus (5-6 Can Bus in a Car). However, in a modern-day car ECUs will have strong interdependence on each other. Also, as vehicles have added more features -- like infotainment, telematics and ADAS – the number of ECUs in each vehicle are increasing there by adding cost & complexity. To address this In a modern-day car ECUs will be replaced by High Performance Edge Computers (80-100 ECUs replaced with 4-5 HPC inside the Car with a Single CAN Bus per zone) fueled by Sensors. So instead 100 ECUs have 4-5 HPC which act as Central ECU, Decouple & consolidate functions from Hundred ECUs to these Central ECUs, build service-oriented architecture rather than CAN Matrix & Central Gateway for secured external communications & integrate with Cloud for online services.
- **Autonomous/Semi-Autonomous**

Driving: - Algorithms will run in the High-Performance Computing Units inside the car. The decisions/insights will be taken inside the Car, but the data collected from various sensors will be uploaded to cloud at a later stage so as to train & fine tune the algorithms at the Cloud & later deploy at the edge inside the Car. For example, angle of turn taken by the Car could be analyzed at the Cloud with corresponding GPS data, train the algorithm to improve accuracy of turn & then deploy the retrained algorithm in the edge inside the car.

- **Next Generation Intuitive Infotainment System:** - To learn what functions and applications users are really using and where the interaction design should be optimized — whether it is the touch or voice interface — machine learning algorithms are an important tool to find relevant insights into the vast amount of available data. Edge computing helps to bring machine learning models, which were trained in the cloud, easily to the device. The local available behavioral and sensor data can be used for predictions to improve user interaction.
- **Predictive & Prescriptive Maintenance of Critical Components:** - Let's take the example of Battery which is a very Critical Component of any Car. Battery maintenance and charging depend on dynamic situations after the car is actually shipped out: like tire pressure, acceleration, traffic, charge cycles, driver habits, etc. Edge Computing will aggregate these data, build the appropriate ML Model & can-do a near real time evaluation of the state of the battery & take/instruct to take appropriate actions. Same is true for other critical components like Tire, Engine etc. This will increase durability of parts & safety of the Vehicle.
- **Value Added Services:** - Automated Parking, Smart Home & Vehicle Interactions, Critical Software Updates, Smart Citi Integrations like Smart Intersections etc.

In Summary, Modern Day Car is a very Powerful Software Platform driven on wheels. Like any other Software Platform, it has its own challenges like Software Integration from multiple entities (OEM, Tier 1- , 3rd Party-)-, Mission Critical Performance & Reliability , Security at both Software & Sensor End , Complexity of Software Updates – Criticality, Version Control , Rollback etc. It brings in several benefits to Manufacturers - new features are much easier to roll out, Cost of Manufacturing reduces & various paid services are rolled out which provides additional revenue stream. For riders. Cost of Operation goes down, gains substantial Productivity – Edge aids to take intelligent decisions & great User Experience in Driving & Riding the Car. Very soon Car will be nothing buta big fat Edge Computer. We will need more & more Computer Science Engineers to build & manage the next

AUTHOR

SUPRIYO DAS
Vice President - Industrial & Engineering Services
Wipro Limited

EMERGING TECHNOLOGY IN AUTOMOTIVE IN PARTICULAR ARTIFICIAL INTELLIGENCE OR DATA ANALYTICS

SATHYANARAYANAN PSV
TOPCODER

Introduction

The global population has been consistently increasing. As obvious, the transportation needs too continue to rise with the increase in population. Last few decades saw the answer to this ever increasing requirement in road transportation in the form of a spurt in the manufacturing of automobiles leading to a near exponential increase in the number of vehicles on the roads. As a result, despite ever increasing investments in road infrastructure in almost all the nations, it is lagging behind everywhere to accommodate the number of vehicles on roads and managing the traffic. The craze for flaunting ownerships, poor public transport, increasing logistics requirement etc only fuelled the demand of automobiles.

In the race to meet the growing demand of vehicles, high speed as a common and a some what competitive feature, accompanied the technological developments in the automotive sector. In the bargain traffic congestions, accidents and poor traffic management became uninvited companions to the commuters and transportation.

Fortunately as the population is increasing, technologies are also evolving day by day in the automotive sector which is witnessing an unprecedented convergence of technologies poised to redefine the mobility on the roads. One of the emerging technologies which is seeing huge interest and innovation across various domain, is Artificial intelligence besides electronics, IT and others.

In this article we will look into some of the applications and concerns in automobile industry related to AI.

Discussion

Accordingly, this examination will be talking about driverless vehicles which have a huge scope of utilizing Artificial Intelligence so as to decrease the traffic on the streets. As said earlier, with the expansion in the population, the quantity of vehicles is additionally expanding. The street furies and mishaps are on the increase and a common every day sight on the roads. And that is the explanation that with the assistance of artificial intelligence

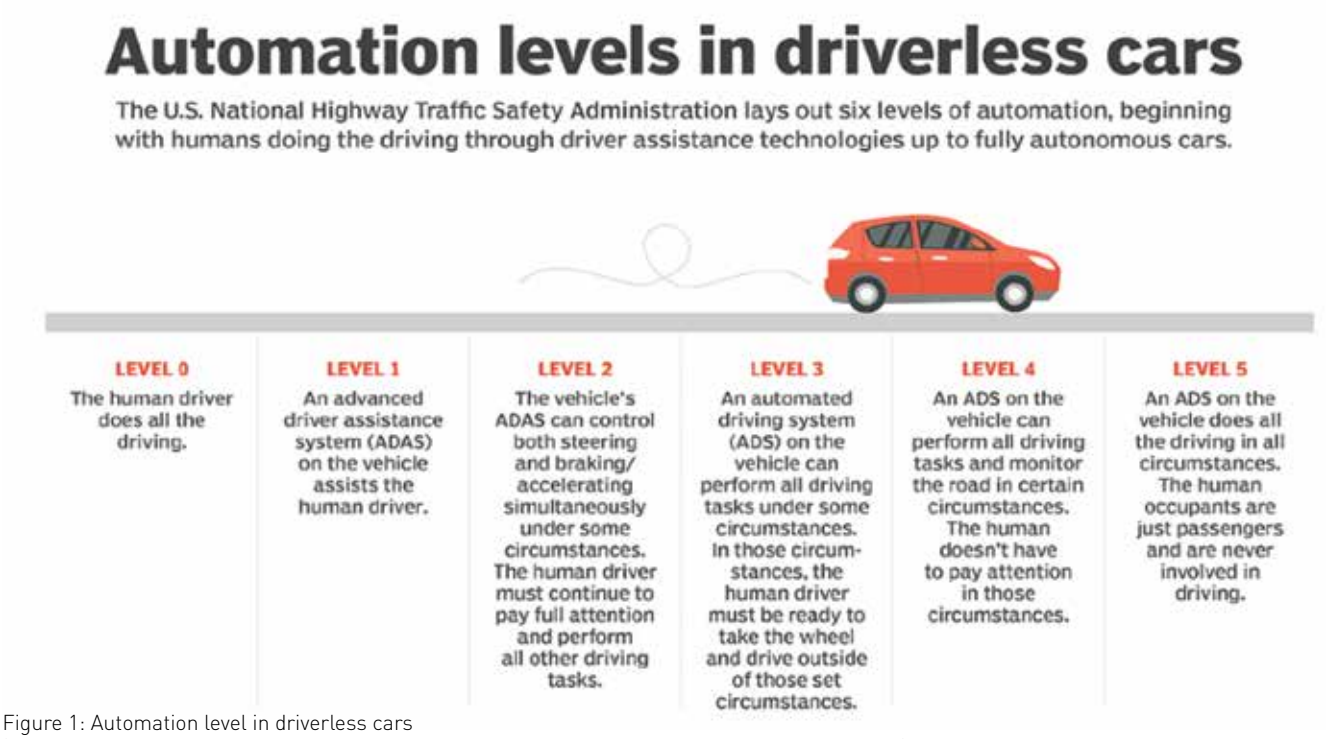

Figure 1: Automation level in driverless cars
(Source: https://cdn.ttgtmedia.com/rms/onlineimages/enterprise_ai-car_automation_levels.png)

& mechanical science, there is a need to build a framework that can deal with the driverless or independent vehicles along with the schedules framework and traffic management (Lin et al. 2017). The administration of traffic is considered as one of the most significant and testing parts in the arrangement of transport. It may be very well said that the number of vehicles in the streets are making it hard to diminish the odds of mishap and as such making it difficult to keep the security of the traffic alongside decreasing the clog in the rush hour gridlock. The mishaps can be one reason that is making traffic management for the executives progressively troublesome, and alongside that, it is affecting the monetary arithmetic of the business as well.

With the assistance of the man-made brainpower, the AI, it will help, not just, during the time and efforts spent in production of the vehicles, AI can also help to decrease the traffic clog by utilizing the AI based applications in the automobile industry. Man-made consciousness or insightful arrangement of robotization assumes a significant job in dealing with those Autonomous vehicles. The Autonomous vehicles are associated with cameras and propelled sensors and alongside man-made brainpower and that helps in giving loads of natural subtleties to the sensors and highlights of the vehicle about nearby environmental factors, as indicated by the data the sensors work for dealing with the streets, signals and traffic. Notwithstanding that, the remote correspondence regularly allows the vehicles to exchange and share data with one another. And that is the way vehicles corporate with one another and control the streets automatically (Miller and Brown, 2018).

Numerous analysts got pulled in by the procedure of convergence as this is considered to be the bottleneck for traffic wellbeing and effectiveness. The automated vehicles are enabled to negotiate the incoming converging vehicles without depending upon the regulating lights for traffic management, and that has occurred because of cutting edge detecting innovations, movement with 360 degree collision avoidance abilities and communication procedures and protocols of these computerized vehicles. Different researcher embrace this idea worldwide for making their advancement regarding effectiveness, and there are additionally a couple of sorts of approaches that can likewise be thought about to handle rush hour gridlocks.

Hybrid approach- this methodology is considered as the need-based methodology, and that characterizes the request to pass a vehicle in the convergence. This methodology depends on the route strategies of independent(fully autonomous) vehicles (Huh and Seo, 2019). At a state of time when two approaching vehicles are estimated to be reaching on a crash point in the junction region, then the activity of the autonomous vehicles which run on AI will be to send the data of their course with the assistance of route work. This data will be sent to the system of traffic management and as per the computations, figuring out the probability of a crash will be done, dependent on the driving headings, area of the vehicle and the speed. As indicated by the trafficking framework if the figuring says that there is a chance of the crash the vehicles which will be closer to the point of impact will be given more noteworthy need and educated to quicken in proceed. In contrast, another vehicle will be educated to back off and pass the other vehicle so as to maintain a strategic distance from the estimated location of probable impact . This need-based methodology can help the administration framework to keep away from any crossing point crash alongside maintaining a balance in the prideful need to right of way and participation among the mechanized

vehicles. These vehicles can adequately stay away from any kind of impact. However in rare cases, vehicles may crash due to out of the blue slowing down for the nearness of a walker (Brynjolfsson and Mcafee, 2017).

The approach based planning - this methodology helps the controller of the convergence to discover directions which are without crash for all the AI incorporated vehicles. As indicated by the directions, the vehicles can cross the convergence serenely. Be that as it may, one of the urgent difficulties in this part is to create directions for a wide range of vehicles which are within range for computing the crashprobabilities related to a crossing point (Gunning, 2017). However, as per not many specialists, it tends to be said that the enhancement issue can be performed utilizing the strategy for advancements like Genetic calculation, Active set technique and Interior point technique. One thing that can settle the issue is that the vehicles can save the directions from the controller of the crossing point. As indicated by the controller, the choice of denying or tolerating for the booking happens. This methodology is very powerful for traffic control since the conduct of the robotized vehicles isn't the idea to the vehicle autonomy and vehicles own control in all traffic situations can't be guaranteed.

Artificial intelligence is the things which cause the computerized vehicles to comprehend what to do and what not to do by utilizing a colossal measure of information captured, and they work concurrently. If they can not compute about any specific something, at any point of time, they are not enabled/equipped for playing out that task. So as to comprehend the path stamping, it should be noticeable unmistakably with the goal that their vision sensors can get that and work appropriately. The sensors of the vehicles ought to be able to recognize the path markings regardless of the street and climate conditions (Hofmann et al. 2017). The luminance, shading and the state of the imprints should appropriately clear for the ground-breaking sensors of those computerized vehicles so that it can keep away from any kind of extra mishaps. Automotive vehicles are updated with specific requests for the state of the traffic, characteristics of the street, locations and indications of the traffic paths. The checking of every single path should be recognized incredibly by the vision sensor of computerized vehicles. It isn't to everybody that machines works as indicated by it is modified, and they don't have their internal information [Referred to appendix 1].

AI as an enabler in Autonomous Vehicles

Artificial Intelligence enablement in vehicles make them safer as the automated system of the vehicles control the vehicle, and that is the explanation for fewer mistakes from doing any off-base things. Because of this framework control, the pace of mishaps has decreased. These automated vehicles utilizing the AI can successfully speak with different vehicles (Kokina and Davenport, 2017). This assistance is diminishing clogs and making advancement to the nature of traffic by the executives by expanding the limit of the traffic path. One of the most valuable power of AI is that in the wake of dropping the traveller, the vehicle consequently looks for parking regions and leaves the vehicle in the appropriate place for next assignment. There are many individuals who are experiencing physical incapacities, and they are not reasonably equipped for driving. However, these AI enabled vehicles can enable any disabled individual to drive without any obstruction, and that is another most helpful thing that these vehicles give.

Concerns in automobile industry related to AI

Like any other new technology induction AI in automobiles brings its own concern areas. Perhaps the greatest test for mass adoption of these vehicles which are utilizing AI is that these vehicles incorporate top notch advances and various bits of high-tech zigs and that is making these vehicles costly (Etzioni and Etzioni, 2017). For everybody, it is very difficult to purchase these sorts of vehicles. So in the car businesses that are working with extravagant features in vehicles can just join the highlights of AI.

An area of concern lies in the possibility that sensors of the AI framework additionally may flop because of the awful state of the climate program, which is introduced in the framework and works within the estimated climate parameters. Because of that, the vehicle may stop in the street, and that can be another burden of utilizing AI in self-governing vehicles as the sensors play a critical role in providing requisite datasets for functioning of AI.

Another cautionary concern area is that while doing the new markings and directions is that the old checking(data set) should be removed well, because in any case, the sensor won't have the option to distinguish which checking needs to be followed for computing as the vehicles will arrive in a circumstance where they have to experience a specific path. On the off chance that there are two stamping together, at that point the sensor of the vehicle won't have the option to gauge which one to follow, and that can prompt disarray alongside ahead into a misguided course.

As the computerizations and modules in vehicles are dependent on the various innovative applications and all the angles are chipping away at correspondence methods (Cockburn et al. 2018), the point of fusing the computerized reasoning is to oversee street blockage and wellbeing for mechanized vehicles. Regardless of the fact whether these vehicles are working dependent on AI, man-made brainpower, amazing sensors and cameras, yet additionally, face loads of troubles because of a couple of issues. These vehicles had the abilities to comprehend the signs. These street marks help in maintaining a strategic distance from crash and deterrents and take an intelligent choice progressively. The primary issue lies in the state of the streets, and mechanization, vehicles need an ideal condition in the street. Even, with the help of AI, vehicles can't react appropriately in many circumstances. For example, rerouted and alternate routes streets, severe climate, streets which are not stamped well and the emotional accidents are the considerations (Fuller et al. 2019) [Referred to appendix 2].

AI as a business adjunct

AI in automotive is not limited to the purpose of driving or the features incorporated in the vehicles, but AI can be subsumed into the consideration of manufacturing. In the process of getting information about the choices and the requirements of the users

or consumers, the strategy towards the manufacturing can be done effectively by gathering information using AI.

Like the GPS(GNSS) in the vehicles helps in driving from the beginning stage to the endpoint by depicting a method of moving ahead, so as to maintain a strategic distance from the crash, these mechanized vehicles utilizing the AI also need to demonstrate the engineering of the street, which can help in characterizing the zone of the impact (Birek et al. 2018).

In any case, in the urban territories, it is very hard to comprehend the discovery of impact in a progressively precise manner and that involved vehicles do not get appropriate data about the convergence and causes of mishaps. So the AI needs to be used in the car business to make legitimate system topologies in the urban zones with the goal that the sensors of the mechanized vehicles get the best possible data from the trafficking framework and work as per that.

Conclusion

Among all the technologies that are using worldwide for various purposes, one of the most promising is the Artificial Intelligence which is quite popularly used across the different technological sector. The business organizations who are working based on the requirements and choice of the consumers are mainly using the AI for getting the necessary information. In this case, as well, the utilization of AI has been showcased effectively using different method and process and how it helps in reducing the chances of an accident while driving in the roads. The big automobile organizations are manufacturing driverless or autonomous cars so that the features of AI can automatically drive a car using different sensors and modules attached in the cars. Those features and benefits also have been discussed in the above research. Few disadvantages which are also there while incorporating the AI in automobiles, have also been discussed in the above study.

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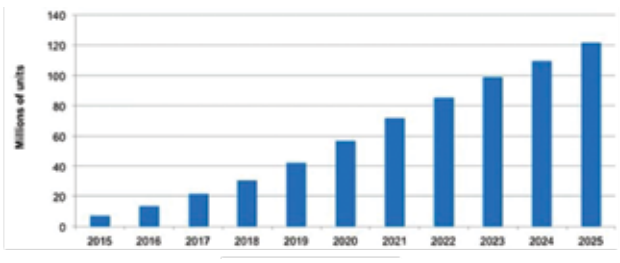
Appendices

Appendix 1: Transforming the automobile industry with AI

(Source: https://i.ytimg.com/vi/8teV79I4iKE/maxresdefault.jpg)

Appendix 2: the rate of units in different year using AI



AUTHOR

SATHYANARAYANAN PSV
Principal Consultant (Data Analytics and AI)
Topcoder

SathyaNarayanan works with Topcoder. He has nearly two decades industry experience across various technologies. He has executed development and delivery on Smart Mobility, Smart City, Smart Manufacturing, Banking re-design using- Data Science, AI, IoT, IIOT 4.0, and Cloud. He has accomplishments in IT strategic solutions, profitable business units through technology integration and formulation of tactical and long-term strategies.

Will Electric Cars Drive Smart Tires?

JAN SVOBODA, JOS UIJLENBROEK
FINELINE

The world around us is rapidly transforming thanks to data which is being extensively shared by end-users, value chain owners, and manufacturers. This type of data driven model will transform the relationship between drivers, OEMs and tire manufacturers, and if embraced by the industry, will provide capabilities to the OEM and tire industry to deliver safer and higher quality user experience.

Use cases developed around Smart Tires identify a number of benefits with the most important ones leading to an increase in safety and reliability, which are often tied to the tire manufacturers quality improvements and reduced liabilities.

With the rise of electric cars, the tire industry is under increasing pressure around the globe to deliver so-called "Smart Tires". On one hand for ensuring safety and quality through the increased end-to-end traceability, on the other hand more and more parts are becoming "connected" to each vehicle for better integration and driver experience. Tires, although one of the most critical consumable components, seem to still be disconnected from the majority of vehicles on the market today.

Last month Tesla announced it was launching its new "Cheetah mode." The world is already familiar with the Tesla "Ludicrous mode" which offers a mind-bending instant acceleration from stand still. The "Cheetah mode" goes a step further. When this mode is turned on, the vehicle's dampers are lowered (such as a cheetah just before the attack) and the car sprints from 0-100km/h in 2.6 seconds. Previously, Tesla drivers were already waiting in anticipation for the traffic lights to turn green so they could have an opportunity to experience the 2.9 seconds acceleration of their Performance Model X as it sprints to the 100km/h. The 0.3 seconds improvement for the new Cheetah mode does not seem like much, but to put it into perspective, it translates to slightly more than a 10% improvement in acceleration. A quick search shows that there are only a few other standard production cars on the market that offer similar acceleration performance, and they include the likes of Porsche Taycan Turbo S, the Bugatti Chiron, 2020 BMW M8 Coupe Competition, or the Lamborghini Huracán EVO. The big difference, however, is that, whether or not we factor in subsidies for electric vehicles, a Tesla is becoming accessible to more drivers than exotic supercars. Exotic supercars are available in limited numbers, for eye-watering prices, and built from superlight exotic materials. Among many aspects, weight is a large contrast between fast and powerful exotic cars, and mass-produced electric vehicles. Some Tesla models weigh as much as 2.5 tons, where many high-performance cars, or even combustion engine cars, weigh far below that.

FineLine's vulcanized RFID Bead Label

The tire industry designers struggle with balancing various important tire parameters such as rolling resistance, noise, wear, grip on dry and wet road surfaces, braking distance, etc. It is also very important to know in which climate and conditions a tire will be used. Electric cars, which look like our everyday passenger cars or SUVs, weigh 30% - 50% more than similarly performing vehicles but deliver limited-edition-exotic-supercar levels of torque and acceleration, require long lasting tires. This equation presents the tire industry with nearly impossible task. And we have not even factored in the different needs of drivers who want to use their Tesla like a Formula 1 car, compared to the drivers who

purchase an electric car for environmental responsibility.

In the Tesla, "Cheetah mode" example, a regular everyday driver gets access to performance capabilities available only to professional race car drivers or the few high performance exotic car drivers. It is highly questionable that all the drivers among us understand the direct impact a tire and its conditions have on the handling and safety of regular driving, let alone driving at much higher limits. This also begs the question if, for example every Tesla driver, is able or willing to purchase the proper model and rating of very expensive OEM specified tires when they need replacing. At the same time, why should an environmentally conscious conservative driver purchase expensive, short life high performance tires, when average all-season tires are perfectly suited to his or hers driving style?

The conclusion is that there is a great need to be able to identify each tire both during the production process and during the use of the tire. Radio Frequency Identification (RFID) is the technology that makes it possible to automatically capture all data from the construction phase of the tire without additional operations or major investments. Drivers and OEM providers are empowered with all the data they need to make optimal decisions when selecting tires for their vehicle.

The trend within the automotive industry is more and more to create a connected car which are communicating with each other about e.g. road conditions and weather. In the future, the needs and profiles of the individual users of a car will be stored in the cloud. The moment all tire data is associated with the car, and driver behavior it is very easy to communicate with the driver in real time about the tires combined with speed, weather conditions etc.

One of the big challenges for the tire and automotive industries is who owns and who has access to the data available from cars, tires, and other connected devices. The moment the OEM shares this specific data, the tire producer will be able to produce faster and better tires in smaller batches specifically produced for a small group of users. In this case the driver using his Tesla as a F1 car will be able to buy the best tires for his use, and the driver whose primary concern is the environment can get tires optimized for completely different purpose to safely work on his Tesla.

But at the moment the tire industry is simply facing the challenge of how to integrate a "foreign device" such as an RFID transponder in a tire construction they have been working decades to perfect. And do this without impacting safety, quality or cost. This is not a simple task for a traditionally conservative industry. The tire industry can approach this with two different mindsets. One, they let their customers, mainly the automotive industry, mandate to RFID requirements. This has been the case across many other industries. It typically puts the manufacturer into a reactive position of following requirements and not having the opportunity to define own benefits and business cases. The other approach is proactive, putting the manufacturer in an advanced position with understanding the technology, use cases, business cases and benefits for internal and customer applications.

The proactive approach puts tire manufacturers in a position to address needs and problems within their own production facility and throughout the supply chain:

- Tracking and tracing of production process steps and the association of these processes to the individual tire;
- Association of the tools and materials used in the production of the individual tire;
- In-bound and out-bound logistics together with accurate inventory management across the tire supply chain;
- Association of tires to rims and vehicles, and the vehicle being able to identify specific tire to improve safety, performance, and user experience according to road and equipment conditions in real time (e.g. tire pressure, temperature, speed, acceleration, road condition, wear, compatibility, etc.);
- Collection of usage data. This input helps aggregate big data for predictive modeling to meet the individual needs of the driver;

This is how enabling Smart Tires with RFID works:

On the individual building machine there is a roll of RFID bead labels individually coded, printed and coupled to the batch of tires which are going to be produced by this specific machine. The RFID barcode bead label will be applied in the bead area or, on the inner liner of the green tire. From this point every process step can be automatically coupled to this individual tire such as molds, bladder and press. After vulcanization, the RFID barcode bead can still be read at around 4 to 5 meters by using a RFID handheld reader or portal. At quality control, the tire will be palatized and coupled to the RFID tag which is applied on the pallet. From this point, the moment we created a "mother/child" relation between the tires (children) on the pallet and the pallet itself (mother). Now, we only need to follow the pallets (warehousing, order picking, loading the trucks) since we already know which tires (children) are inside.

Suppose at quality control, a tire is rejected (normally around 2%) for whatever reason, with one push of a button we can download, real time every process step of this rejected tire. Data collected from the building area, molding and quality control can be used to determine if a specific production line needs to be shut down and investigated. By using a simple RFID barcode bead label, it is very easy to diminish the number of rejected tires within the production processes. If, for example the failure is caused by a defect segment in a mold. Again, with just one push of a button the tire producer is able to clarify which other tires have been produced by the mold. Locating those tires (mother/child relation between tires and pallet) within the warehouse or supply chain is a piece of cake, using RFID bead labels.

Automotive OEMs are requiring specific tires to be installed on each car during production. For safety, quality, performance and warranty purposes, OEMs are pushing tire producers to share more and more production and quality data for each individual tire. Using RFID tags and labels make this possible. The same RFID tags vulcanized in tires also enable a new generation of cars to register each individual installed tire in the ECU. Using an industry standardized

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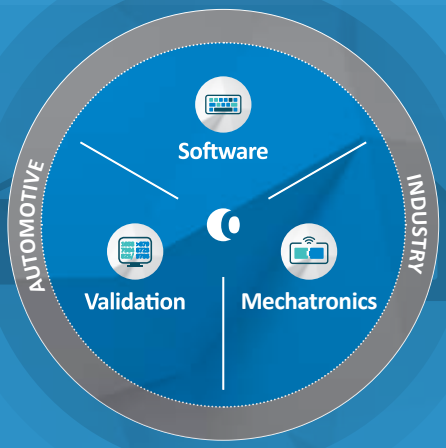

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ISO process, the tires RFID data is stored in the respective wheels' TPMS sensor memory. This step can happen during the tire mounting process on the wheel or sometime before the wheel is mounted on a completed car. TPMS sensors are required on most vehicles for most global markets, and they are largely supported by most vehicles wireless ECU BUS. The vehicle simply retrieves the tire data from the TPMS memory and now has full awareness of the individual tires installed in each position.

Due to the variety of operating requirements and parameters that drive those, the production logistics of tires will change drastically. Today, large batches of the same tire are produced in large scale, while balancing productivity, efficiencies, quality, and manufacturing tolerances. Future production of tires for electric cars (but not just for electric cars) will require a different model, a model enabling much more flexible and diverse product offering of customized tires with specific parameters available within tight tolerances. Customers will require greater freedom of choice and tire offering suitable to their needs and environment. This requires a radical change in the production philosophy and processes of the tire industry, from manufacturing through logistics, service and installation. That radical change is the inclusion of RFID tagging devices with the manufacturing environment and end product. ❑

AUTHORS

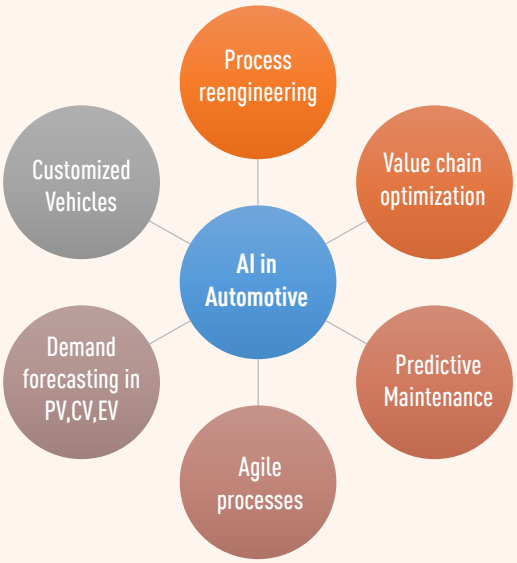
Jan Svoboda
Director, Business Development & RFID FineLine Technologies
Jan has over 20 years of experience in technology and solutions development within the high-tech industry. His extensive knowledge of RFID and wireless technologies is based on years in product development, product management, business development, sales and strategy roles at companies such as Zebra Technologies, SATO Corporation, SMARTRAC and Komtus.

Jos Uijlenbroek was a co-founder of Ferm RFID Solutions, now a division of FineLine Technologies (USA). Jos has been instrumental in the design and implementation of RFID solutions for OTR, passenger, and TBR tires. He spearheads key international RFID-projects and partnerships. Jos is also a certified and pro-active GS1-member and guest lecturer at different Dutch universities.

AI FOR AUTOMOTIVE STRATEGY

PAWAN CHHIBBA

A lot has been written, said and discussed in the domain of Artificial Intelligence. From the Turing test conducted by Alan Turing in 1950 which offered an opportunity to understand whether machines can exhibit intelligent behaviour to AutoML (Auto machine learning) by google which claims to reduce the dependency on humans to build AI models, the technology has come a long way. However, the question that still intrigues many is whether this new wave of digital intelligence is intelligent enough to create value. This is one of the biggest challenges C-level executives in manufacturing industry face when they propagate the idea of investment in this technology. Preparing a business case and binding the investment to the RoI, in an asset heavy industry, becomes a daunting task and many at times hinders the buy-in or progress of such programs across the manufacturing enterprise. The risk of failure is perceived to be large despite the inherent advantages of the AI technology and most of the companies try to reduce the risk by shifting the ownership of assessment and implementation across plants to technology consultants, vendors and value chain partners.



Artificial Intelligence solutions are being increasingly deployed across sectors such as healthcare, logistics, telecom, education, fintech, banking, ecommerce, agriculture, entertainment industry, sports, media etc. and these sectors have realised the benefits too. Manufacturing industry has been the forerunner in adaptation of technology and is expected to derive the maximum value from the implementation of technologies. So whether it is the use of Industrial

IoT (IIoT) which offer humungous data on machines and their performance and paves ways for predictive maintenance, or the use of big data along with mathematical models to predict the demand forecast, a lot can be offered by AI to transform the industry.

The use of AI is also being propelled by GoI and the National Strategy on Artificial intelligence mandated in FY2018-19 with the intent to create an ecosystem of AI technology became the stepping stone in this direction. As per a report by Accenture AI has a potential to add approximately 1 trillion to the economy of India by 2035. This gives the necessary push to manufacturing enterprises to identify and implement opportunities in the field to offer technological advanced products and services, creating customer stickiness.

However, the question remains – What RoI can those automotive enterprises which invest or intend to invest in these technologies generate? One way to look at the return on investment is the improvement in productivity across the manufacturing value chain, the valuable business insights the technology generates such as manpower productivity, process performance and agility, and asset utilization, to take necessary business decisions. One advantage of the digital economy is the availability of a huge amount of resources which reduces the technology adaptation and learning curve for organizations which are part of the manufacturing sector, creating a low barrier to entry. This leads to ease of product imitation and extensive competition among the participants for the share of business, decreasing the value delivered to the organization and its customers. Moreover, as the volatility and complexity of technology increases from one model to another, i.e. as data velocity, veracity, and volume increases, and as models adapt and self-optimize to these changes and graduate from basic search algorithms to complex neural networks and to machines teaching machines, enterprises can no longer create value by offering technologically advanced products alone.

In an asset heavy manufacturing sector, strategic advantage must be created by evaluating areas which cannot be easily imitated, areas such as processes. It is the unique attribute of non-imitability of the process that gives competitive advantage to many manufacturing enterprises across the world and ensures the loyalty of the customers. It is this area that has remained largely unimplemented across manufacturing setups despite it being the forerunner in the area of automation and technology. IOT devices and sensors can collect data on existing manufacturing process parameters which can be analysed by a neural network to identify NVA (non-value added) activities, opening up opportunities to redesign the process, convert existing setup to lean and creating unique opportunities for the enterprise. With the shift in the customer expectations from a functional product to a low cost, feature rich, high quality vehicles, the price pressure has increased on the auto manufacturers who are already struggling with low demand due to Covid19, high asset base, huge inventory carrying costs, and skewed fixed costs. Redesigning processes by use of the insights generated by implementing AI, these auto manufacturers can create a great strategic advantage for their customers through optimization of costs.

Automotive players can use the McFarlan's strategic grid (Fig. 1) to map the present system and to plan for technologies they would want to adapt in order to generate competitive advantage and to align their operations to the business strategy. The focus should be to adapt those projects which can help the enterprise to move from the 'Factory' quadrant to the 'Strategic' quadrant.

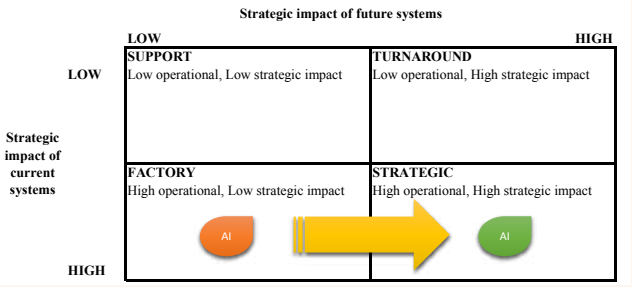


Fig 1

Business case for AI adaptation hence can be strengthened by showcasing the alignment of the new technology initiatives to the business strategy. Process improvement projects in manufacturing setups can include the study of man and material movement through use of legacy CCTV infrastructure to earmark existing routes and the AI solution can be used to optimize these paths with the aim to optimize the cost function. Impact on bottom-line can be assessed by conducting a study on the manpower deployed across the factory operations and efficiency improvement opportunities can be predicted by the AI enabled systems. High maintenance machines and equipments along with NVAs can be identified to isolate problems and to further the improvement of the process. Non imitable process redesign to create strategic advantage should become the ultimate goal for all the players in automotive sector.

Though auto sector has always been an early adopter of technologies which is evident from its foray into EV segment and same is true in case of AI technologies too, there still remain many opportunities for implementation which can be aligned to the overall business strategy. Delay in undertaking critical AI projects can result in loss of competitive positioning, creating a huge barrier to growth of market share and the bottom line specially when the auto sector is already struggling with keeping the momentum of the cash flows and Covid-19 is expected to create further degrowth.

AI technology is here to stay and the best time to unleash the might of these technologies in the automotive sector is now. ❑

AUTHOR

PAWAN CHHIBBA

He is an independent consultant to organisations in the area of Artificial intelligence and Machine Learning. An IIM Calcutta Alumnus, Pawan has more than 15 years rich experience of working with C-suite executives in MNC and Start ups in India and USA. His interest areas are Digital manufacturing, IIoT, Data analytics, ML & AI.

Acquisitions & Investments

Argo AI receives $2.6B funding from Volkswagen

Argo AI which develops the virtual driver system and high-definition maps, will now be sharing its technology with Volkswagen along with Ford. Argo calls itself self driving technology platform, developing software, hardware, maps and cloud-support infrastructure tfor self-driving vehicles. It has fleets of autonomous vehicles mapping and testing on public roads in Austin, Miami, and Washington DC.

Volkswagen will be funding $2.6billion for platform development. Earlier in 2017, Ford had invested $1billion in Argo. Though, Ford and Volkswagen are sharing the investment in Argo, they will not jointogether for self-driving vehicle.Argo's board will now be comprised of two VW seats, two Ford seats, and three Argo seats.

Amazon to buy self-driving startup Zoox

Amazon.com Inc. which was in talks to purchase driverless vehicle startup Zoox Inc., has finally closed the deal at US$1.2 Billion. Earlier, there were two other companies interested in buying Zoox. But, for the $1 billion price which was coming as hinderance in its sale. Back in 2018, zoox was valued at US$ 3.2 billion, when it was targeting a totally driverless car by 2020.

Amazon is exploring an opportunity to automate the supply chain, including the last mile delivery to its customers. The rising shipping costs is expected to cost Amazon upwards $60 billion by 2025. Earlier, it had purchased warehouse robot-maker Kiva Systems in 2012 for $775 million and now has tens of thousands of robots in warehouses across the world. Last year, Amazon revealed an experimental delivery robot called Scout, which is like a handcart and on experimental basis rolls on sidewalks of Seattle, to deliver goods.

Ola Electric acquires Etergo, an electric scooter OEM

Ola Electric Mobility (Ola Electric) announced(June20)its acquisition of Etergo BV, an electric scooter OEM, based out of Amsterdam. Founded in 2014, Etergo has developed electric AppScooter, which has won awards for its innovative design and engineering at CES 2019 and Automotive Brand Contest, Germany amongst others. First revealed in 2018, the AppScooter uses swappable high energy density batteries to deliver a range up to 240km.

Ola Electric has been working for last few years, in electric vehicle space in India. In 2017 it launched electric vehicle for its shared mobility service in Nagpur. Named-Mission Electric, it had about 200 electric vehicles deployed in this project. Ola took learning from this project and next year hived off its electric vehicle business, and Ola Electric was created. In little over a year, Ola Electric joined unicorn club in July 2019. Presently, Ola Electric is running pilot projects to deploy electric vehicles and charging solutions across cities with a focus on 2 and 3 wheelers.

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Rajasthan Commission proposes new business models for EV charging infrastructure

The Rajasthan Electricity Regulatory Commission (RERC) has issued a draft order inviting feedback on its proposal for new business models for setting up public electric vehicle (EV) charging infrastructure. The RERC proposed EV charging infrastructure to be set up under two models – DISCOM-owned public charging stations and privately-owned public charging stations. The Commission asked interested parties to submit their responses on or before June 29, 2020.

It said DISCOMs were allowed to set up charging stations at their own premises or any other suitable location, as required. Meanwhile, it allowed any interested private parties or investors to set up these stations while adhering to the Ministry of Power's (MoP) and Central Energy Authority's (CEA) guidelines and standards. It said that private charging stations could only operate upon acquiring clearance from the designated DISCOM. The RERC also announced incentives to public charging stations. These stations are allowed to purchase power under open access agreements. They are also allowed to set up battery charging stations after obtaining due clearances from their DISCOM, according to the Commission. They are also allowed to set up rooftop solar projects under applicable regulations.

Additionally, the RERC directed DISCOMs to propose a capital investment plan to update its network to accommodate the charging infrastructure after discussing it with stakeholders and interested investors. It urged DISCOMs to encourage major energy companies like Indian Oil Corporation and Hindustan Petroleum Corporation to invest in these solutions along state and national highways, as well. The Commission also asked state power utilities to implement smart charging features and smart metering facilities at all public charging stations to help manage loads and ensure long-term grid security. With smart charging and metering in place and growth in solar applications, the DISCOM is advised to review the time-of-day hours and propose variable time differentiated pricing to avail maximum benefit of available day time power.

Mahindra owned GenZe shuts down US operations

Mahindra-owned company- GenZe, was one of the few with an actual US factory and that built vehicles in the US. Going by recent announcement by Mahindra, GenZe will be shutting down its US operations. It is in the process of liquidating GenZe's assets after deciding to shutter a number of its unprofitable subsidiaries. GenZe will reportedly be completely dissolved in the next six months. Mahindra has said that GenZe's intellectual property will be integrated into other Mahindra products and subsidiaries.

GenZe had been known for both its electric bicycles and its electric scooters. The vehicles were popular with ridesharing companies, demonstrating how the GenZe two-wheelers were often overbuilt for the needs of an average rider. The GenZe 2.0 is electronically limited to 30 mph (51 km/h), which could occasionally be a bit limiting on larger roads, but it was an awesome utility vehicle for living in the city.

Ampere launches electric scooter

Ampere electric vehicles, launched e-scooter Magnus Pro priced at Rs 73,990 on Monday 15 June'20. Magnus Pro, with an average range of 75-80 km per charge, will be available in the Bengaluru initially.Magnus Pro comes equipped with features such as anti-theft alarm, digital LCD cluster, mobile charging point, bright LED lights, LED DRLs (daytime running lamps), telescopic suspension, 450 mm leg space, and large storage boot space. "Magnus Pro will be an exciting new option in the high-speed e-scooter segment with a host of comfort, safety, convenience, and stylish features," P Sanjeev, COO, Ampere Electric said.

RR Global enters electric vehicle segment

RR Global, Mumbai based firm, is making an entry into the electric vehicles segment. It plans to invest INR 1.25 billion (Rs 125 crores), through its internal funding, in the next three years in this venture. The company plans to launch two electric scooter models under the brand name 'BGAUSS' by the first week of August with prices starting from Rs 50,000 to Rs 99,000.According to Hemant Kabra, Director, RR Global Director, "The reason why we entered into this (electric vehicles) space is because of the forward integration we are trying to do. We understand this space, power train – motor controller, cluster, battery, wire harness, lightning etc and 70 per cent of the components, we do day in and day out. We understand it very well" .Further for the EV journey, the company will have its own products in its bike, within the 8 months to 1 year onwards. Currently, it is using Bosch Motor and controller.For the EV venture, the company is "renting facility" inside its own premises which may churn our 80,000 units annually and may be scaled up

to 2.5 lakh per annum.RR Global is planning to launch its electric two-wheelers in the Southern and Western regions in seven states. In starting, it will be rolled out in cities such as Hyderabad, Chennai, Bangalore, Pune, and Coimbatore.The company is additionally performing on a cargo model electric vehicle, which has seen a huge demand after the outbreak of COVID-19.

REVISED GUIDELINES FOR EV CHARGING STATIONS

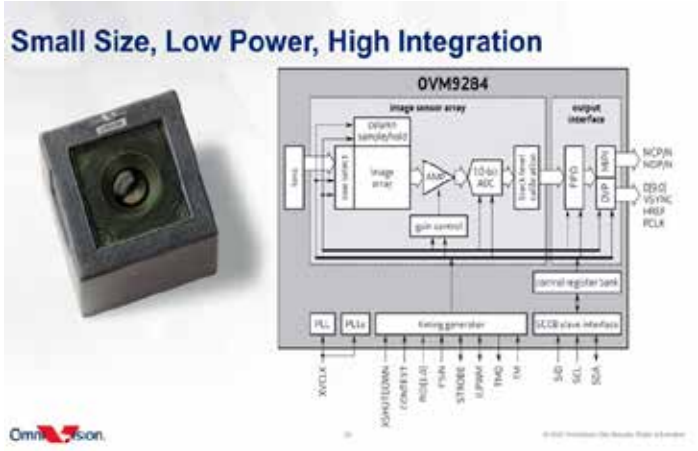
The Ministry of Power, Govt of India, has issued an amendment to its guidelines and standards for the charging infrastructure of electric vehicles (EVs). The guidelines were issued by the Ministry in December 2018 and were revised in October 2019. The amendment has now specified that the tariff for the supply of electricity to the EV public charging stations should not be more than 15% of the average cost of supply of power. This ceiling was not given in the earlier guidelines. Besides this, the amendment has added a few more important points to the existing guidelines. The amendment has now added a clause to say that for all practical purposes, the battery charging station (BCS) will be treated at par with the public charging station (PCS), and the applicable tariff for electricity supply will also be the same as for the PCS. Here, PCS means any EV charging station, while BCS implies a station where the discharged or partially discharged batteries of EVs can be recharged electrically. As per the amendment, the captive charging station for EVs will be fully owned by the owner of the charging station, and it will not be used for commercial purposes.

According to the revised guidelines issued in October last year, a phase-wise installation of an appropriate network of charging infrastructure throughout the country was envisioned. The aim was to make sure that at least one charging station will be available in a grid of 3 km x 3 km in the cities and one such station to be set up at every 25 km on both sides of the highways.

Regarding the public charging stations, the ministry previously clarified that setting them up will be a de-licensed activity, and any individual or entity has the freedom to set up these stations.

India: EESL to set up 2,000 EV charging stations in FY21

EESL, joint venture of PSUs under the Ministry of Power, plans to ramp up the installation of electric vehicle (EV) charging stations in India. It is planning to setup over 2000 charging stations across India by the end of FY 2020-21. Out of these 2000, about 500 charging stations will be set up in the Delhi-NCR region. EESL has already installed over 300 EV charging stations in India. It plans to set up over 10,000 charging facilities across India over the next two or three years. EESL is joining hands with municipal authorities of cities to set up the public charging stations in cities like Ahmedabad, Jaipur, Chennai, and Noida. Itisalso working with companies like Maha-Metro, BHEL, HPCL, Apollo Hospitals, and others to setup charging infra in their premise or land assets available.



Wafer-level camera module for driver monitoring systems

OmniVision Technologies, in June'20 announced the OVM9284 Camera Cube Chip™ module. It is an automotive-grade, wafer-level camera. This 1 megapixel (MP) module has a compact size of 6.5 x 6.5mm. It has low power consumption and image sensor has a 3 micron pixel and a 1/4'' optical format and 1280 x 800 resolution. Its mass production is expected in Q4 of 2020.

Toshiba's ICs for In-Vehicle Infotainment Systems

Toshiba Electronic Devices & Storage Corporation ("Toshiba") has added "TC9594XBG" and "TC9595XBG," new interface bridge ICs for automotive In-Vehicle Infotainment (IVI) systems, to its lineup of display interface bridge ICs. Sample shipments start this month.

WAVE brings wireless charging solution to maintenance depot

Wireless Advanced Vehicle Electrification (WAVE) is bringing its wireless charging infrastructure solution for a maintenance depot in Josephine, TX, USA.

The WAVE system consists of a charging pad embedded within the pavement. And transfers power through the air to a receiving pad mounted on the vehicle's undercarriage. Its inductive power transfer eliminates the hassle of cords or overhead infrastructure. The system requires no cables or connectors and has no moving parts, substantially reducing maintenance requirements both on-and-off the bus.

Million-mile electric vehicle battery

The Chinese company Contemporary Amperex Technology Co. Ltd. (CATL) has been making electric vehicle battery since 2011. It has been supplying lithium-ion batteries to Tesla, Volkswagen, BMW, Toyota and others. According to an interview given by its CEO Zeng to Bloomberg recently, CATL has developed million mile electric vehicle battery. Its battery pack can last about 16 years and 2 million kilometres (1.24 million miles). Zeng, 52, mentioned that it would cost only about 10% more than presently used electric vehicle battery. There was no such mention whether any contracts for the long-distance battery pack have been signed.

CATL has entered into a two-year contract in February to supply electric vehicle batteries to Tesla for its Shanghai giga factory. Tesla elsewhere has been using Panasonic and LG Chem Ltd batteries.

CATL is adding a production facility in Germany. It will provide about 70% of batteries required by BMW, an early customer of CATL.

Tesla and GM too have been working on long distance electric vehicle batteries. But, none have claimed to reach a million mile battery.

Second opinion matters

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US: Academic institution engaged for testing autonomous vehicle

The Florida State College at Jacksonville (FSCJ) will be working with Jacksonville Transportation Authority (JTA) on autonomous vehicle program. In the last week of May 2020 an MoU was signed which includes: (1) The expansion of the Ultimate Urban Circulator (U2C) Test & Learn Program to FSCJ's Commercial Driver's License Test Track on the school's Cecil Center Campus; (2) The development of an autonomous vehicle deployment or "Agile Plan" on an FSCJ campus and (3) Development of curriculum and educational initiatives relative to autonomous vehicles, and related technology. As the JTA continues to innovate through the U2C project, senior members of the Authority's Automation division will begin developing a curriculum and other educational initiatives in conjunction with FSCJ faculty that will focus on autonomous vehicles and other innovative technologies to prepare the workforce of the future.

Germany: Increased subsidy for electric vehicle

German government is set to double existing subsidies to €6,000 ($6,720) on electric cars that cost up to €40,000 ($44,800). This is expected to benefit automobile manufacturers to sell vehicles that are better for the environment. The subsidy is expected to help Germany recover from effects of the coronavirus pandemic. The proposed subsidy budget is €2.2 billion ($2.5 billion). Automobile manufacturers and their suppliers will receive another €2 billion ($2.2 billion) to assist research and development. German finance minister Olaf Scholz said that this was part of a broader effort to improve the climate. "This is about renewable energy. This is about initiative which will help us become carbon neutral economy by 2050. We have started now".

Norway: Recycling EV battery material and aluminium

Battery manufacturer Northvolt and Hydro set up a joint venture in June'20, called- Hydro Volt AS, to work on recycling of battery materials and aluminum. They will be setting up a "battery recycling hub" in Norway, with operations proposed to begin in 2021. The battery recycling hub will crush and sort lithium-ion batteries. At first, it will have the capacity to process over 8,000 tons of batteries per year. Recycling at the facility will segregate aluminum and black mass. Black mass refers to a substance containing lithium, cobalt, manganese, and nickel. The black mass will be sent to a Northvolt facility in Sweden, where its raw materials for new battery sets, will be recovered. Northvolt has set a target for 50 percent of raw material in 2030 to come from recycled batteries. Volkswagen Group and Hydro, have invested in Northvolt. Elsewhere, Fortum, whose majority owner is that the Finnish state, says it can recycle about 80% of materials in a lithium-ion battery. Like Northvolt, it also uses a hydrometallurgical process to recycle the batteries.

Austria: Regulatory framework for charging infrastructure

In a recent decision the Austrian Higher Administrative Court governed that the commercial operation of charging points for electric vehicles does not fall under the Austrian Energy Act. Putting an end to the long-lasting debate and vagueness around the legal classification of such operators. As an outcome, charging point operators are not bound by the stringent regulatory regime set out by the Austrian Energy Act. The Austrian Higher Administrative Court put an end to the debate; that the sale of electricity by charging point operators doesn't qualify such operator as an electricity company within the meaning of the Energy Act. The regulatory burden on charging point operators has been lowered.

Image Courtesy: Ola Mission: Electric.

China: BMW and State Grid EV to work on charging infra

BMW Group in first week of June 2020 signed an agreement with State Grid Electric Vehicle Service Co. to work jointly on charging infrastructure. Under this cooperation, BMW will build over 270,000 charging piles by the end of 2020, of which 80,000 are DC piles that support the fast-charging mode, and have its charging network cover more than 50,000-km expressways nationwide.

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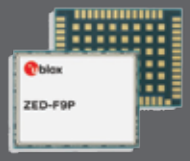

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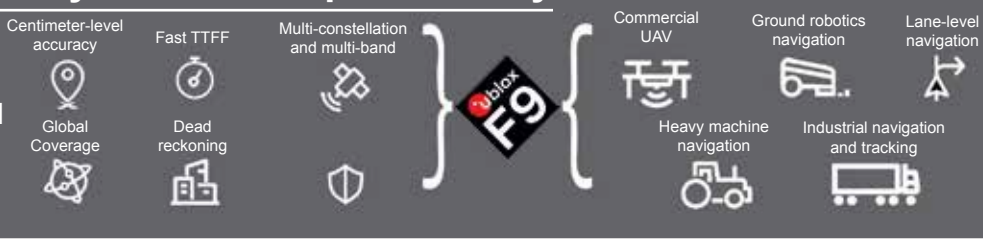

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