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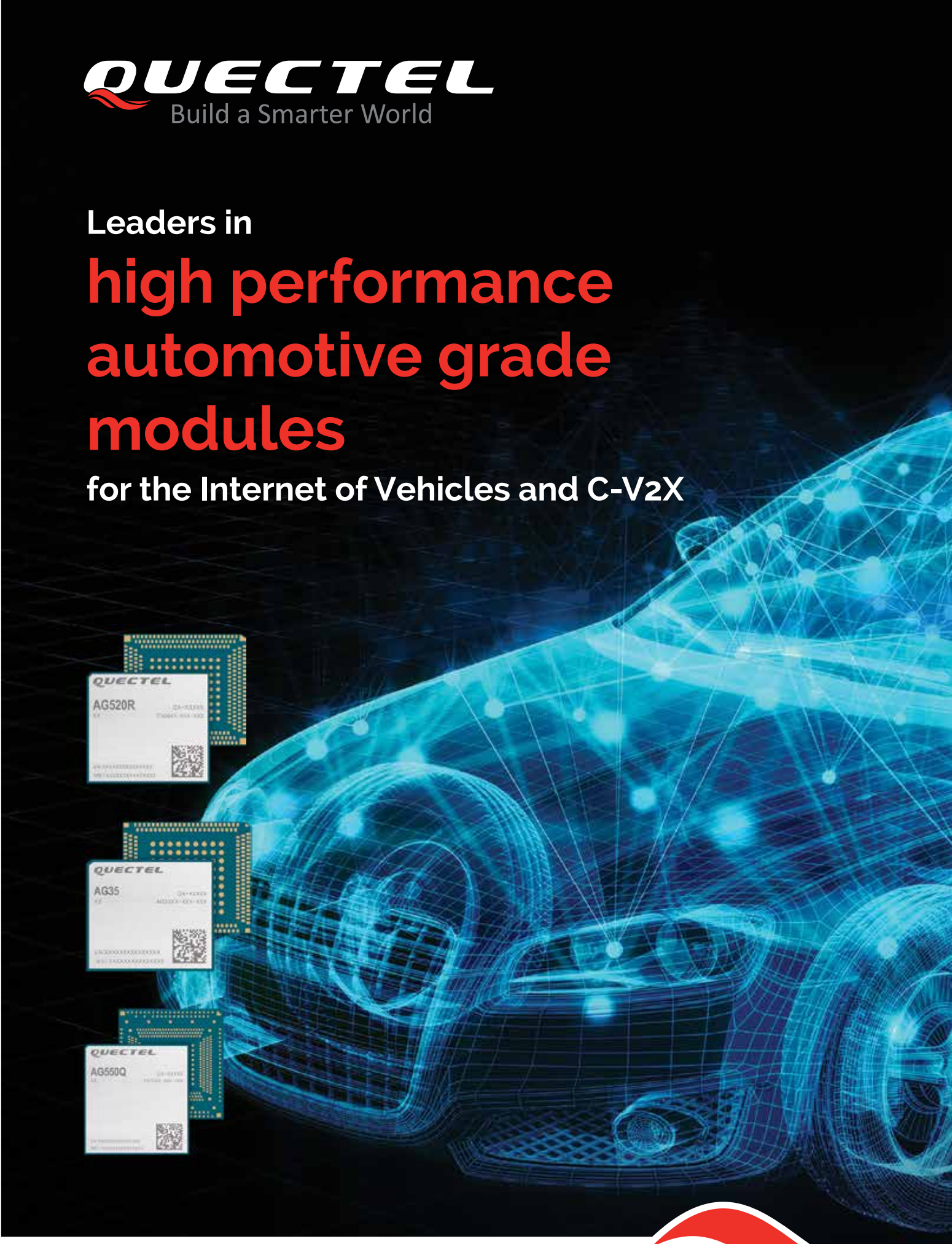

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The crisis of Covid-19 2nd wave in India

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Last month and half has been extremely difficult due to the second wave of Covid-19 pandemic for us in India. We saw a series of crisis emerging out of various reasons leading to skewed supply of medicines, oxygen, oxygen concentrators, hospital beds, and more. This for sure will be deliberated at larger forums and lessons drawn out of for better management of such emergency situations, if they happen in future. In the midst of the crisis we also had our Ministry of Road Transport and Highways notifying through an official tweet that transport vehicle carrying oxygen for medical use, has to be necessarily fitted with vehicle tracking system.

Vehicle Tracking System (VTS) or more commonly understood as GPS tracking has become a buzz word in the last few years, with earlier crisis of Nirbhaya case too lead to mandating use of VTS in public transport vehicle (even cabs) with emergency alert buttons for use by passengers for their safety. These are great technology based policy initiatives, but we should be looking forward to a comprehensive solution, where the system for passenger safety in public transport has feedback in place. In other words, the data captured, including the alerts due to pressing of the panic button, their corresponding response, effectiveness of response and where ever the system needs improvement; it should be made. Here in, data analytics and its integration with decision making could be a game changer, if it is not already in place. It will not only improve the safety of passengers but the data could be used for many verticals in the public transport.

Taking a step back to the use of vehicle tracking for transport vehicle carrying oxygen. The primary objective is to ensure prevention of any detour or delay along with safety of vehicle transporting oxygen. For sure, it is a good step and would help diffuse the crisis in supply arising due to breakdown or any other mishap with the vehicle carrying the critical supply. One would wonder here, if the destination is predetermined, could the vehicle tracking data be integrated with the entire supply chain of the hospital or processing unit. When supplies are marked at the point of despatch itself, as we heard from news in many of the cases, the vehicle location data along with estimated time of arrival could be an important input to the medical institution or the processing unit. Also, the tracking data could be dynamically shared on a real-time basis with the local administration, police and traffic to ensure there is no undesired incident en-route. As we hear about frequent accidents on roads, many a times due to driver fatigue or carelessness, we could also look for integration of driver/occupant monitoring system to ensure the alertness of driver carrying the critical supply. Though it's an implementation nightmare for sure, for a country big as India, but could be considered and maybe experimented for any such future need, if there is a crisis, be it in different shape and colour. Needless to say how the domain of logistics & supply chain management has benefitted from vehicle tracking could provide valuable inputs in this.

Within the urban centres, there was movement of important medical supplies from one place to other. Mostly oxygen, which was to be transported to the hospitals in a minimum timeframe. Green corridors were created. Nothing new, earlier also we had seen such 'Green Corridor' being created for movement of time-critical things, including 'donated organs' being moved from one hospital to another. Left to imagination, I wish in the connected world, where the vehicles too are connected not only through telecom network but also through V2V communication, such vehicles like 'Ambulance' are able to dynamically create a green corridor on their way. It may be a far fetched wish, but it is something where we will see connected vehicle saving lives on a day to day basis without administration or traffic police involvement.

EMERGING TECHNOLOGIES

Artificial Intelligence and Machine Learning for Vehicle Engineering

DR. AJAY N. PALKAR
SKODA Auto Volkswagen India Pvt. Ltd.

The invention of the wheel revolutionized the concept of mobility for the entire human race. This gave birth to the car in 1886 and only later in 1908, was this vehicle available to the masses. The 'wheel' generated hope in terms of rapid movement and the car brought controls like comfort, pleasure of driving, and of course – light! Being in the possession of a car was a luxury till only a few decades ago!

When the technology is couples with car designing, it gave rise to Super Mobility that progressively made more complex and reliable machines which became increasingly easy to manoeuvre.

With technology going up in leaps and bounds there was not an iota of doubt that this automobile would to transform into Smart Mobility Vehicle.

Future Mobility will be with the advent of latest technology; Electric, Connectivity, Internet-of-things (IoT), Cloud Computing, Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL). Today there are many innovative features that enhance the car & the ecosystem for Electric Vehicle, Autonomous Vehicle and Car Sharing.

In towns and cities, there is a dire need of sustainable solutions of car sharing such as combined multiple modes of transportation including private cars, public transport, robo-taxis / shuttles, micro-mobility and cycling, in order to address the problem of congestion, pollution and quality of life.

Refer Figure 1: Technology Drivers, Transforming Automotive Industry clearly questions "WHO NEEDS BASIC MOBILITY?". Technology Drivers are pushing the Ecosystem to get it transformed into a Value Chain for OEM's. Stakeholders; Vehicle manufacturers, Technology providers, Govt. authorities and many more to have strategic plans in place to provide effective solutions. Overcoming hurdles, aggressive predictions are being made for meticulous planning, sagacious investments and execution methodologies.

Artificial Intelligence and Machine Learning

Artificial intelligence describes the work processes of machines that would require intelligence if performed by humans. The term 'artificial intelligence' thus means 'investigating intelligent problem-solving behaviour and creating intelligent computer systems.

Artificial Intelligence can be divided into 5 categories;

• Machine & Deep learning

A set of algorithms used to model the high level abstraction of data, monitored and evaluated continuously. A single mistake can be captured and resolved automatically.

• Industrialization

Robots have dominance over the Manufacturing, Assembly and Production. They work effectively, efficiently and reliably.

• Digitization & Data Processing

Data recording and processing has been phenomenal over the years. Traditional activities are no longer effective and scraped. Data management software's will create database for further processing.

• Micro & Mega Economies

With the advent of Web-based Networking techniques, stakeholders are able to manage the businesses in the most efficient way. Various applications are being developed and used to run on the online platforms.

• Autonomous driving

No human interventions. Vehicle runs using sensors, navigation techniques and self-governing capabilities.

Hence, Artificial Intelligence will lead to redefine business models for the products and systems. This affects both; Product and Service sector as well the whole eco-system on which the businesses will run. The eco-system, Cyber Physical Systems (CPS) into production and logistics and Internet of Things (IoT) are the blood and vessels of the businesses. CPS is the data bases and

Figure 1: Technology Drivers, Transforming Automotive Industry

information sharing platform between humans, machines, products, objects and information and communication technology systems.

In Vehicle Engineering, automatization has four levels; first the production is controlled by machines configured by humans, second, real-time production is the core feature, third is a decentralization and forth is industrialization where NO human intervention. There are economic benefits; reduced production cost, better presence in competitive market.

The following Figure 2: The trends shaping the Auto Industry from now to 2030 describes, how AI & Machine Learning is playing a very important role.

Here, I would like to discuss three major applications of using AI & ML for Vehicle Engineering,

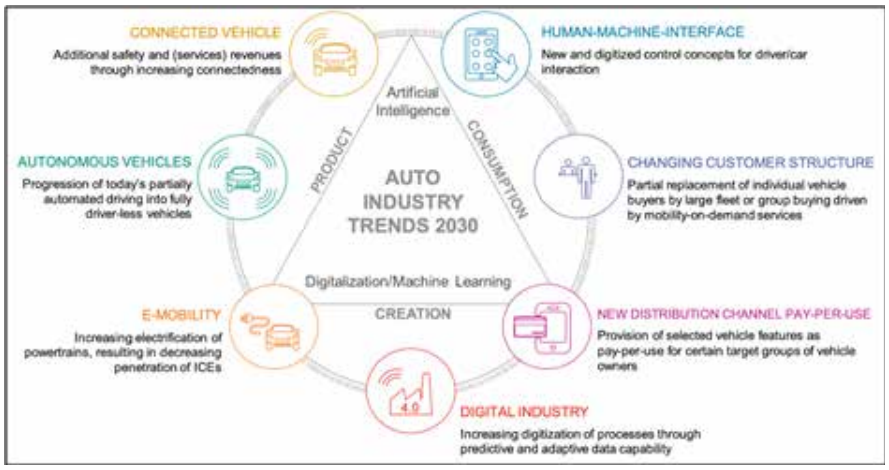

Figure 2: The trends shaping the Auto Industry from Now to 2030
Source: Oliver Wyman Analysis

1. Predictive Maintenance

Automotive predictive maintenance software with online support system based on Microsoft Azure cloud services can be developed for vehicles that processes requests for appointments and syncs drivers to the nearest dealer services.

The online system also notifies drivers by phone message or email about the need to check parts that have exact maintenance schedules stated in the vehicle specifications, which are synchronized with the online system.

The Machine learning algorithms will recognize for example:

- Starter motor malfunctions
- Drop of pressure in the fuel pump
- End of a battery's service life

It is possible to develop a vehicle predictive maintenance solution based on machine learning algorithms that collects data from steering and braking systems as well as from the starter motor, battery and fuel pump and relays the information to the cloud for analysis and diagnostics.

Few indicative steps for a predictive maintenance algorithm for battery life:

- In-car monitoring system checks battery status
- Data is transferred to the cloud
- Cloud-based ML algorithm predicts that the battery will run low
- System processes all inputs and prepares advice to the driver
- Notification system sends a message to the driver with instructions
- Driver takes action based on the recommended instructions

2. Pedestrian Tracking & Collision Prediction

Urban populations are growing exponentially alongside the number of personal and public transportation, and last-mile delivery vehicles. These vehicles share increasingly crowded streets with pedestrians and cyclists, who are the most vulnerable road users. Globally, pedestrians accounted for 25% of road fatalities in the year 2018.

Besides street congestion, blind spots of large buses and heavy vehicles are another cause of incidents. Drivers must manoeuvre quickly and accurately while staying alert to any nearby movement. Workers on foot can also be exposed to potential harm on industrial storage sites from forklifts. With a full load completely blocking the view, forklift drivers may have more blind spots than areas of clear vision.

All these pedestrian safety issues can be addressed through an AI pedestrian collision prediction module.

It is possible to develop a pedestrian collision prediction module which analyses data about the position of pedestrians, their predicted locations, and road coordinates.

The module comprises of the following components:

- Pedestrian detection
- Pedestrian trajectory prediction
- Road segmentation
- The pedestrian collision prediction module itself

Pedestrian detection is conducted with the Realtime Object Detection algorithm. The module for pedestrian trajectory prediction with Kalman Filter obtains the speed and velocity of a pedestrian from the detection module to predict their motion. Then the pedestrian detector searches for the best-match appearance to update measurements. The output of the previous calculation is an input for the next one. The result of the Kalman filter is an adjusted pedestrian trajectory.

The Road segmentation module distinguishes driving lanes from the sidewalk and outputs images with labelled road pixels. The module is usually handled by a Convolutional Neural Network (CNN), a Deep Learning Methodology.

The Pedestrian collision prediction module calculates the probability of a collision using the coordinates of a pedestrian bounding box, which are predicted and obtained from the object detector paired with the Kalman filter, and the road coordinates from the road segmentation module. If these coordinates of a pedestrian bounding box do not intersect with road coordinates, the vehicle and pedestrian collision is of zero-probability. In case of an intersection, the collision probability equals the ratio of the distance to the predicted pedestrian location and the distance of detected road available for the car.

Active safety technology for preventing pedestrian collisions is important to protect vulnerable road users and move toward zero-traffic-accident society. Using AI and ML solutions, OEMs built

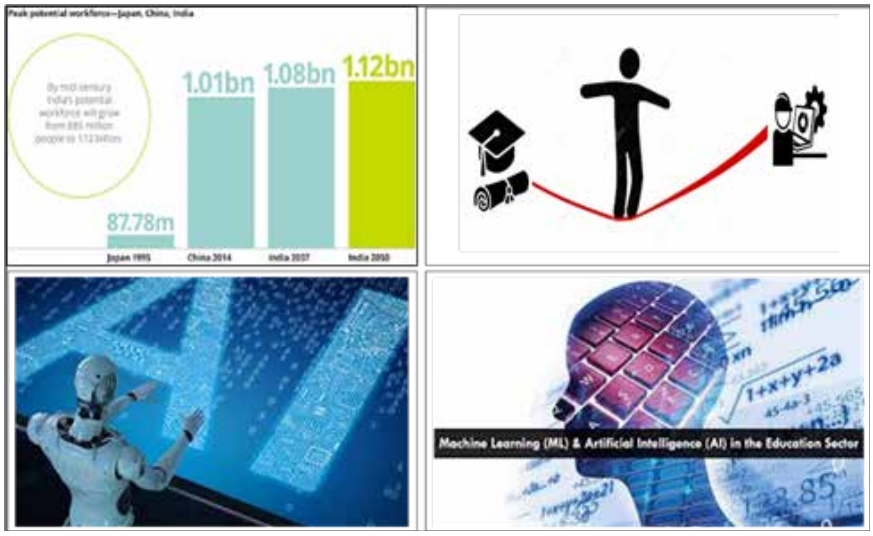

Figure 3: Workforce requirement by 2050 and Gap between Industry & Academia

intelligent vehicles that can perceive and react to road conditions up to 99.8% which is better than human drivers.

Being an extra pair of eyes, a pedestrian collision prediction module addresses the challenge of monitoring hazardous blind spots for drivers of both private cars and large vehicles manoeuvring in narrow lanes and around people on foot. Once the possibility of hitting a pedestrian is detected, a driver will receive a visual and audio alert, thus getting more time to react. If the situation is defined as critical, the brakes will be applied automatically.

The advanced pedestrian trajectory prediction module will support automakers in enhancing the safety parameters of vehicles in urban, rural, and industrial environments. By equipping fleets with a pedestrian collision prediction module, companies will reduce incidents and associated costs and, most importantly, save lives.

3. High-Definition Maps and Cloud Data Platform for Autonomous Driving

One of the major requirement for Fully Automated Driving (FAD) is 3D HD Maps, the creation of the maps i.e. eliciting source data to creating and publishing the maps themselves. AI can support in this activity. The map development process is sequential and happens in five major stages:

• Real-time streaming perception

An Edge Perception stack is developed that allows for HD map observations and crowd-sourced updates using vehicle-mounted sensor systems. The process involves detecting road features in video streams in real time. This dynamic data is then used in the development of self-healing maps. In case of any changes on the roads, maps are updated automatically, and the new map data is delivered to end users in real time.

• Data collection

To build detailed and credible maps for navigation systems and custom solutions, accurate information on road attributes needs to be collected from around the globe. Data is gathered from mobile cameras, sensors, and GPS devices on the road to locate traffic lights, signs, poles, stop lines, lane markings, roadside barriers, junctions, etc.

• Data aggregation, processing, and filtering

Engineers handle massive datasets from a variety of sources, including from core maps and on-vehicle sensor systems. All road image data is aggregated, processed, and filtered via a streaming file system for further validation and intelligent analysis using machine learning models. All data can be consumed in an NDS (Navigation Data Standard) format to avoid vendor lock-in and ensure interoperability across systems.

• 3D map creation and maintenance

Live 3D maps are compiled & updated that enable precise positioning for lateral and longitudinal control of vehicles. These multi-layer maps contain details at several levels (roads, lanes, lane groups and individual lanes, geometry) and are constantly enriched with incoming information on new road attributes such as signs, markers, crosswalks, bicycle lanes, and objects.

• Map delivery

Data-intensive HD maps are generated and delivered to customers online as a geographically tiled and functionally layered data service suitable for direct-to-vehicle and OEM cloud consumption. These maps are also an indispensable source of data for client's many in-vehicle software development programs.

There would be many such tests and a huge number of algorithms running in the vehicle environment. All the stakeholders; Vehicle manufacturers, Technology providers, Govt. authorities, Academicians have their own share of work to support this humongous initiative.

Indian Research Universities / Institutes have a pivotal role to play. Currently, there is huge GAP between 'what we learn' and 'where we apply'. Industry and Service sectors in India would require a gross incremental workforce of > 1.12 billion by 2050; India could potentially emerge as a global supplier of skilled manpower. Refer Figure 3: Workforce requirements by 2050 and Gap between Industry & Academics. Going ahead the organizations anticipate a huge shortfall of qualified and skilled employees. Since business strategies are not clear, there is a need to procure, control, retain and nurture talent. This may be the key to combat competition.

Various Indian universities have started offering programs / degrees in AI or computer science and engineering with a specialisation in AI and machine learning. There is a need to structure our education system towards the future industry requirements.

- o Further research is needed to identify Software / Algorithmic profiles, not only for the vehicles but for the overall environment.
- o Universities / Research institutions should be supported by the authorities

to lead / develop and execute the educational programmes.

- Creating appropriate tools, flexible leaning programs, practical systems and reforms, knowledge hubs, teaching methods etc.
- Partnerships with global entities; education hubs, technology partners, technology start-ups help to enhance faculty knowledge.
- Initiating efforts to enhance employability, collaborations with industrial giants and consulting experts.

India as a developing country, is in process of reforms to encourage the AI talent. However, a well-structured process and systematic action plan for the development of AI talent needs to be defined where all stakeholders contribute equally and responsibly.

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Ajay is an Industry recognized thought leader over 30+ years of Product design, Development & Management consulting experience. An accomplished, performance driven & focused professional having rich experience in Engineering & Management mainly focusing Vehicle Integration (Mobility, Electrical & Electronics), Systems Engineering, Project Management, Strategic Planning & Business Development in Automotive, Defense, and Industrial Automation & Instrumentation field.

His core research area is Product Life Cycle & Obsolescence, Strategic Management and Project Management. He has published numerous papers on Technology & Marketing Management, various patents & memberships on his name.

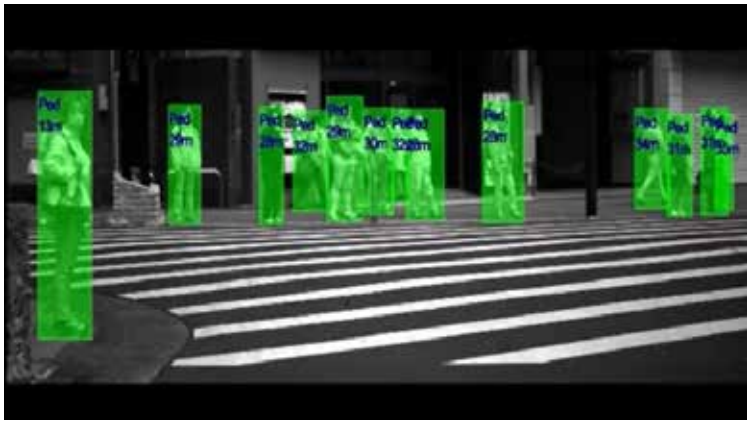
Why is true-solid-state the future in automotive applications?

JACOPO ALAIMO
XenomatiX

Lidar is the most effective self-driving detection technology to enable safe and affordable autonomous vehicles. But the automotive industry needs lidar systems to be small, robust and able to see targets at long distances in high resolution. By far, solid-state LiDARs have caught the attention of the automotive industry in the past few years. Solid-state LiDARs are sensors based on a silicon chip without requiring mechanically moving parts. So why choose a true-solid-state LiDAR? Eliminating all moving parts not only makes LiDARs more resilient to vibrations, but also more fit to thermal load and more affordable at high volumes.

Does a solid-state system not imply the complete absence of moving parts?

The "solid-state" definition has been used to classify different types of LiDARs leading to some confusion also within the LiDAR community. Solid-state can describe the type of laser source and detector, i.e. when semiconductors are used. MEMS based LiDARs are often claimed to fall in this category despite relying on moving micro elements for changing the laser direction.



Also, recent FMCW technology adopted by big players like Aurora, Intel, and Aeva pretends to be solid state. Clearly this is not correct when a scanning mechanism is still required for steering the laser wave. Some of the FMCW LiDAR using OPA (Optical Phase Array) can correctly be classified as solid state but have a very low technology readiness and still many technical aspects to resolve. Compared with the original spinning Velodyne LiDAR, these technologies greatly reduce the number of components, size, weight, and cost often with improved performances, but they do not change the paradigm of scanning the scene and do not bring the scalability and simplification to make LiDAR accessible for low-cost applications.

With the need to distinguish its technology, XenomatiX, introduced the attributes "True" to identify solid-state LiDAR systems that meet the definition in all aspects: XenomatiX technology is true-solid-state because it is made with a semiconductor-based laser source and detector and because it is realized without scanning nor moving components, delivering simplicity and scalability required for reliable mass production.

'The only moving part is the vehicle'. This philosophy has guided XenomatiX since it began developing its multi-beam LiDAR in 2013. XenomatiX uses a unique concept of performant global shutter: with a multi-beam 'discrete flash' projection, XenomatiX' LiDAR generates a high-resolution grid of measurement points, still achieving long range performance.

The recently launched XenoLidar X projects 15,000 laser beams simultaneously, obtaining a resolution of 0.15° horizontal and vertical, with a more than 150m range.

And at the same time (frame) the point cloud is constructed, the LiDAR receiver chip simultaneously takes a 2D image: a 2in1 with lidar and camera data, inherently fused!

Automotive Integration and Modularity

Two prerequisites that cannot be ignored in the transportation world are style and efficiency driven by aerodynamics.

Style has always been at the center stage for automobiles and fuel-efficiency and aerodynamics are prominent since years. Not anymore relegated to sport-cars, these aspects are optimized across vehicle segments and especially in electric vehicles to increase range and EPA ratings.

So the AV or ADAS sensor-stack has to be accepted by the established OEM's styling and aerodynamics departments. And as such, sensor integration is an absolutely necessity. On this point, scanning systems exhibit some weaknesses. Such devices rely on expensive components and complex architectures that only become cost efficient if they can cover a large field of view. On the other hand, a large field of view requires broad visibility and elimination of any possible "dead angle". Unfortunately, this is quite incompatible with the shapes of today's vehicles – based on trends seen at auto shows, this appears to hold true also in the foreseeable future. Tesla adopted a solution hiding and integrating cameras all around the vehicles with style and aerodynamic driving the camera location, not vice versa. Why do we expect LiDAR to follow a different destiny in the OEM hierarchy?

XenoLidar-X supports a centralized vehicle architecture, where multiple LiDARs are placed at different positions in the vehicle connected to a single processor for sensor fusion.

True- Solid-State LiDARs: the new leap forward

Though several other lidar companies have now followed XenomatiX lead in developing solid state sensors, this is a nod to XenomatiX trailblazing rather than a threat.

"We see that some companies are trying to implement this technology as well – and we see that as a recognition of a validity of our approach." said Filip Geuens, XenomatiX CEO.

While the race to be the top lidar company has intensified, with new players joining the market, many are still iterating upon the original scanning lidar technologies and trying to incrementally improve performance. What solid state lidar may do is to provide a disruptive alternative, allowing innovation to make the next leap forward. ❑

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Jacopo joined XenomatiX to lead the expansion of its revolutionary and simple LiDAR technology in the North American region. With the vision to contribute to safer roads and transportations he is convinced of the advantages that the True Solid State could bring to the AV world. In his earlier career he covered managerial positions in Marelli – Automotive Lighting and Koito – North American Lighting supporting the introduction of LEDs technology while guiding people on the mountains around the world. Jacopo earned an MS in Aerospace Engineering and a Mountain Guide Certification, qualifications that reflect his passion for exploration and techniques.

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Connected vehicles – Finalised guidelines from the EDPB

GABRIEL VOISIN, CLARA CLARK NEVOLA
Bird & Bird LLP

In January 2020, the European Data Protection Board ("EDPB") issued draft guidelines on connected vehicles. On 9 March 2021, the EDPB has published their finalised version (accessible here) of these guidelines. Below, we have set out and assessed the main differences between the draft and the finalised versions.

Rentals

A significant change in the guidelines relates to rental vehicles. The finalised guidelines have re-moved almost all references to connected vehicles used for rental purposes. The draft guidelines provided specific guidance for rental companies providing connected vehicles, with practical advice on privacy and security settings, data retention and data subjects rights, which has been deleted in its entirety from the finalised guidelines.

Vehicle data as personal data

The draft guidelines already explained that, unsurprisingly, most data collected via connected ve-hicles will be personal data as any data not directly identifiable could readily become so by cross-referencing with other files such as the vehicle identification number. The EDPB have clarified this further, by affirming that a connected vehicle is to be seen in the same light as any other terminal or device such as a computer. The fact that the vehicle could have many users should not indicate that the data collected on the device is not personal data - "[the] potential plurality of users does not affect the personal nature of the data".

Consent

As we highlighted in last year's article, the EDPB draft guidelines stated that consent could be the most appropriate legal basis for the processing of connected vehicle data, as the vehicle itself should be considered to be "terminal equipment" for the purposes of Article 5(3) of the ePrivacy Directive.

The EDPB has not changed tack on this and has in fact gone even further in this approach. New text in the finalised guidelines states that it would not be possible to argue that further processing of the data is possible under Article 6(4) GDPR as considering further processing as "compatible" with the original purpose of processing would "circumvent the very principle of the consent re-quirements" of the ePrivacy Directive.

The EDPB guidelines is clear that if controllers wish to further process data from connected vehi-cles, they must obtain separate consent from the individual unless they can rely on Article 23(1) GDPR i.e. if there is national law that allows the further processing for combatting crime, ensuring public security or other important public interests.

This view is conservative and diverges from the approach that many in the industry will have taken. It may also have implications for industries such as Adtech and IoT more generally.

Speed data and criminal offences

Another significant change in the finalised guidelines is a reversal in the EDPB's original comments on vehicle speed data. Originally, the EDPB had stated that vehicle speed data was not, of itself, offence related data but rather data that could become offence related data if it is being used for the purpose of identifying road infractions.

The finalised guidelines have removed this analysis and instead state that vehicle speed data combined with geolocation data could amount to offence-related data, leaving the guidelines less definite on this topic.

Privacy settings and personalisation

The EDPB have also added more clarity on how personalised services affect the provision of pri-vacy settings. In the original draft guidelines, the EDPB had made clear that vehicles must provide clear and easy privacy settings to allow the user to control the data collected and transmitted from the vehicle.

The final guidelines clarify this further by giving an example of a contract offered to a customer on the basis of specific driving behaviour (e.g. lower insurance premiums for drivers who don't exceed speed limits). The EDPB explains that "drivers should be enabled to stop the collection of certain types of data, temporarily or permanently, at any moment" even where such contracts are in place, but that the services (e.g. the insurance, in our example) can be reverted back to the default offer rather than the more advantageous personalised one.

The impact of this comment is that it defeats any possible argument that collection of personal data is based on contractual necessity under GDPR - the EDPB's view is that it should always be based on consent and can therefore be revoked, even if this impacts on the contract.

Impact of the final EDPB guidelines on national DPA guidance

Certain national data protection authorities had issued domestic guidelines on connected vehicles pre-dating the EDPB document. The French Data Protection Authority (CNIL) had for instance is-sued a series of recommendations back in 2018 (accessible in English here). The CNIL has indi-cated it will update its national guidance so as to reflect the position elaborated in the context of the EDPB discussions. ❑

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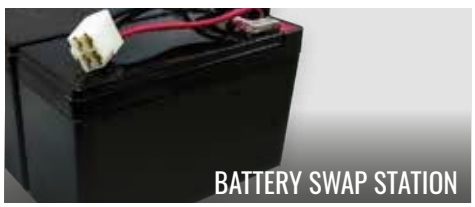
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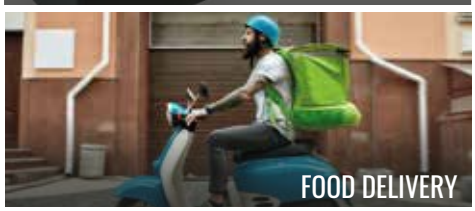
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Application of Blockchain and 'Digital Twin' in Automotive Industry

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Automotive is one of the many industries which is undergoing a series of changes at an exponential rate. There are also a lot of new technologies evolving in other industries which can be applied to automotive industry to help in addressing various challenges and bring optimisation within the automotive industry.

'Blockchain' and 'Digital Twin' are such technologies which can be applied in automotive sector to transform product, processes, services and maintenance. This article covers the features and application of these technical concepts in automotive industry and their benefits.

Blockchain

As per Wikipedia

"A blockchain is a growing list of records, called blocks that are linked together using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree). The timestamp proves that the transaction data existed when the block was published in order to get into its hash. Blocks contain the hash of the previous block, forming a chain, with each additional blocks reinforcing the ones before it. Therefore, blockchains are resistant to modification of their data because once recorded, the data in any given block cannot be altered retroactively without altering all subsequent blocks."

Source - https://en.wikipedia.org/wiki/Blockchain

In simple words, Blockchain is a shared, distributed & immutable ledger to record transactions and track assets across the network. This digital ledger records transactions publically and validates all transaction data seamlessly. Some of the features of Blockchain are:

- **Available** – Since there are multiple participants in a blockchain network, there is no single point of failure.
- **Immutable** – Each record is stored in blocks, which has a cryptographic hash of the previous block forming a chain, with additional blocks reinforcing the previous ones. Hence, resistant to modifications.
- **Transparent** – The transactions are visible to all participants with same copies on multiple nodes thus ensuring transparency of the information held.
- **Irreversible** – The records in a blockchain network are irreversible and enforcing a new transaction to compensate the previous one will ensure full visibility of records.

and many more.

There are primarily four types of Blockchain networks which are:

Public blockchain: It is publicly available and has no access restrictions.

Private blockchain: It is controlled by one organisation which also controls participator and validator access.

Hybrid blockchain: It is composed of centralised and decentralised features.

Consortium blockchain: It is maintained and managed by multiple organisations.

Digital Twin

A digital twin can be described as a digital replica of the physical object. Various attributes of state of the physical object can be tracked using sensors and mapped to its digital copy to keep both the physical and digital states in sync. Digital twin helps in establishing the following aspects:

- Monitor the product usage in real time.
- Remote diagnostics and troubleshooting.
- Analyse the behaviour of physical product and predict future performance.
- Understand limitations of the product and improve.
- Run simulations on the digital twin to predict behaviour and improve the product.

These technologies can be used together to provide resilient and reliable information about an automobile and establish a digital twin for prediction, diagnosis and improvement of future automobile designs.

Manage Digital Model using Blockchain

Manufacturing an automobile comprises of a complex network of manufactures and suppliers requiring specialisation in specific areas spanning across geographically distributed departments and companies, however, it still spins around Automotive Manufacturers, which are mainly responsible for producing the end product.

Although, Automotive Manufacturers produce some of the equipment themselves, they are more focused designing vehicles, ordering required parts from suppliers and assembly of the final product.

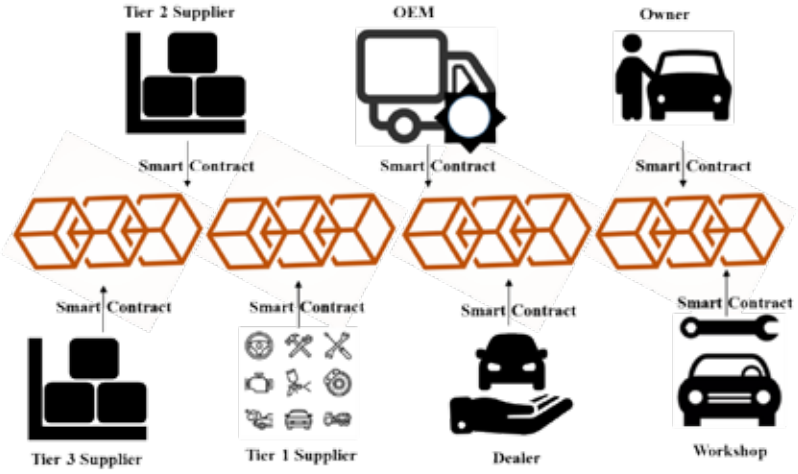

Figure 1

Tier 1 suppliers supply parts directly to Automotive Manufacturers and are capable to produce automotive parts.

Tier 2 suppliers are also engaged in supplying automotive parts, however, they do not provide parts directly to Automotive Manufacturers but Tier 1 suppliers.

As far as Tier 3 suppliers are concerned, they provide raw materials for manufacturing of automotive parts to Tier 1, Tier 2 suppliers and Automotive Manufacturers.

Blockchain can be used by all the concerned parties to add details of the respective components and raw materials via smart contracts in the Blockchain network. It can also keep the records regarding the vehicle ownership transfer as contracts.

The above statement is an over-simplified view of the entities involved for the manufacturing of an automobile and is represented in Figure 1, showing automobile production and maintenance lifecycle details as smart contracts in a Blockchain network.

Since, the value chain for the manufacturing automobile mainly comprises of Automobile Manufacturers and Suppliers, establishing a Consortium Blockchain network for managing smart contracts across respective entities will be more appropriate. Considering the consortium Blockchain, it will mainly consists of OEMs, Tier 1 and Tier 2, the approximate number of nodes of the Blockchain can be ~60. This will ensure that a trust is established between all the participating entities responsible for providing the end product. The Blockchain also need to have appropriate access rights to Dealers, Government transport and law enforcement agencies. Since this type of Blockchain network is controlled by a consortium of participating entities, hence it can established as Proof of Authority based network where transactions and blocks are validated by approved accounts.

Since, we are targeting this Blockchain network to store a digital replica of the automobile, we will focus on aspects of integration from production and maintenance point of view. This means the physical entity details are appropriately logged in the Blockchain accounts. The various physical aspects of producing vehicle such as raw material, physical parts, electrical parts, assembly, tyres etc. will be registered as smart contracts within the Blockchain.

All these details will be electronically secured and available in Blockchain and will represent a newly produced physical vehicle. All this information weaved together will provide required information to represent the digital model of the physical entity.

Connected Vehicle to enable Digital Shadow

Nowadays, most of the automobiles are connected to the cloud and are capable of sending all the critical & relevant information related to their performance. This information can be stored as temporal data in the associated Blockchain network of the respective OEM. It ensures that the physical state information of respective components of any vehicle at any timed snapshot will be stored securely as Smart Contracts in the Blockchain network. The digital information of all the components of the vehicle at any point of time represents the digital shadow of the vehicle at that instance.

We can use the above information to establish 'Digital Twin' of any automobile.

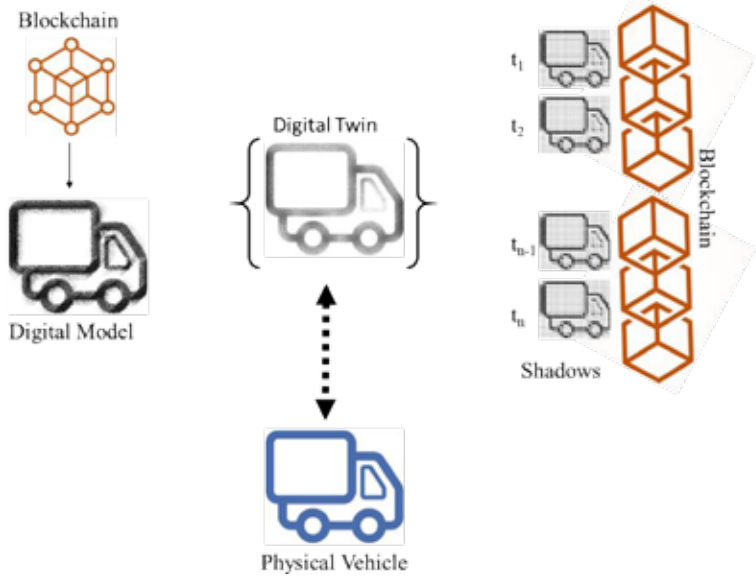

Figure 2

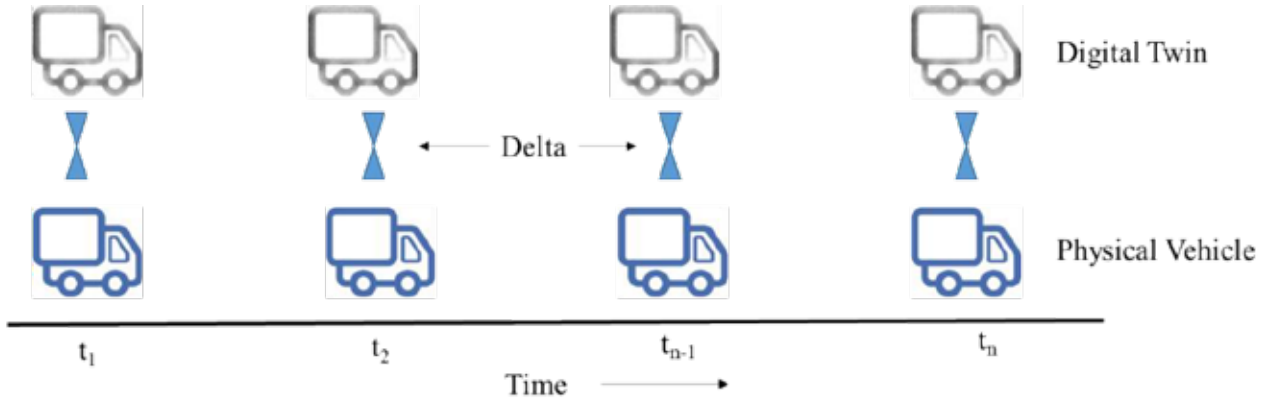

Figure 3

Deriving Digital Twin

Normally, the digital information collected from a physical asset is often referred to as Digital Twin. However, I believe that the information so collected represents the shadow of the asset not exactly the digital twin of the physical asset.

Now, to construct a digital twin, we need to overlay the digital shadow information over the digital model of the product. The digital model of the asset represents the physical asset that has all the information about the construct of the asset which is mostly static in nature and the digital shadow of the asset contains the information collected from the associated sensors to various parts of the asset which is dynamic in nature as time-series data. These two information models when merged will present the 'Digital Twin' of the asset.

In context to Automotive, the vehicle information collected during the production process of a vehicle will represent the Digital Twin of a vehicle. This information is provided by entities that participated in the production process of the vehicle, and collected by a associated sensor over a period of time. Figure 2 illustrates the fabrication of Digital Twin by am amalgamation of 'Digital Model' and 'Shadow' of a vehicle.

> **"...BLOCKCHAIN AND 'DIGITAL TWIN' CAN IMPROVE BUSINESS PROCESSES, SHORTEN MANUFACTURING LIFECYCLE, ENABLE AI/ML TO FORECAST RESULTS.. IMPROVE CUSTOMER SATISFACTION...AND SHORTEN THE DELIVERY CYCLE"**

The 'Digital Twin' will have both the static and dynamic information of the vehicle and thus can be used to analyse various aspects of the vehicle related to wear & tear, servicing requirements, life of auto parts, predicting the lifespan of a vehicle, improvement of future design, improvement of raw material usage & type and also execute various analytical models to understand the behaviour of a vehicle.

If we consider that the information related to vehicle servicing and auto part replacement is also maintained in the Blockchain network, then we will get two models to be compared with each other.

The first one being the 'Digital Twin' and the other being the actual state of the physical vehicle using the information captured during the vehicle servicing and auto part replacements. The delta between these states i.e. the one using 'Digital Twin' and the other being the actual physical state of the vehicle will help in re-calibration of the prediction model. Also, in understanding the consumption of material for the production process and the optimum conditions to elongate the life of the vehicle. Fgure 3 is a visual representation for the same.

To summarise, I believe that automotive industry can utilise the technologies such as Blockchain and 'Digital Twin' to improve existing business processes, shorten manufacturing lifecycle, waste reduction, establish trust between various parties, providing accurate and trusted information to apply AI and ML tools and techniques to forecast and compare the derived results with actuals, thus improving product, customer satisfaction level and shorten the delivery cycle. ❑

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Fueling IoT with Big Data

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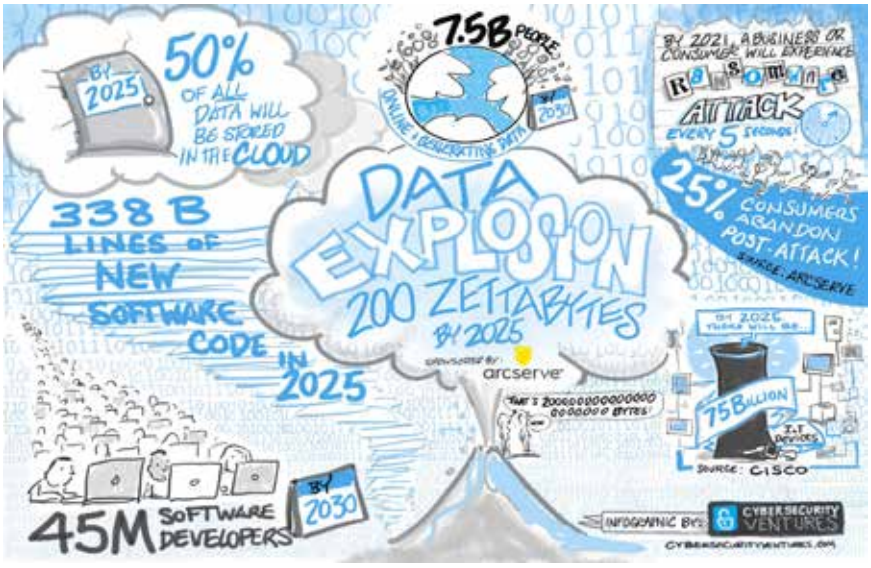
With the rapid deployment of 5G around the globe and a prediction of 127 Billion connected devices by 2030 (Ref[1]), there is a lot of investment and efforts being put by businesses towards IoT. To put this into perspective, given that the world population is expected to reach 8.5 billion in 2030 and the connected devices to reach 127 billion would mean around 15 connected devices for every person. The decade of IoT has just begun and industry experts call IoT as the next big industrial revolution named as Industry 4.0 which is expected to be much bigger than any of the previous industrial revolutions.

Better predictability, cost savings and efficiency in operations are few of the many offerings being presented by Big Data, combined with IoT. This deadly combination can be a game changer for many businesses in Industry 4.0, specifically in fields like Logistics, Health care, Mobility where a lot of efforts and money are being spent in optimization and automation. Currently 82% of industrial corporations are either using IoT or running a pilot or planning to adopt it in the near future (Ref[2]).

IoT acts as a feeder network to the ocean of Big data. Once the data is fed into the data lake, telemetry data combined with other data which were in silos, together will raise the data value exponentially. This data when processed appropriately creates huge value and context for the businesses as it can be used as an information capable of creating insights for better decision making hence making it data driven than biases.

Only 15% of the data is being utilized effectively today, rest is just a heap of data lying around. Hence it's not only important to gather data, but it's important to have smart data collection and make the most use of the available data. This further shows how much potential is thus available in Big data that can be explored using IoT.



Source: CyberSecurityVentures (Ref [3])

IoT and Bigdata strategies for your business

IoT strategy

With numerous IoT and data platforms out there, it might be overwhelming to choose the right platform and design the IoT strategy.

These are some of the questions which will give a clarity while making the choice of the right platform for your business:

1. What's the problem that I want IoT to solve for my business
2. What are my device profiles and what protocols would they speak
3. Would I need Edge or my devices can directly communicate with the cloud
4. Scale, number of devices and data volume being collected

With the answers to these questions and main priorities for your business, helps you converge towards picking the right IoT platform. If a platform completely satisfies your needs, that would be a perfect, else necessary tradeoffs must be made to select the best fit in the available choices.

Data strategy

Once the IoT strategy and platform is decided,the next decision must be about the data which the platform has collected, data strategy.

Some of these questions would ease your decision making process:

1. What is the nature of the data - Media (Audio/Video/Images) or Text
2. How quickly are data insights required- Real time or Batch
3. Data quality - what data is good data
4. How would the data be consumed- Analytics? Machine learning? Monitoring/Alerting?
5. Who are the stakeholders consuming the data
6. How long the data is required

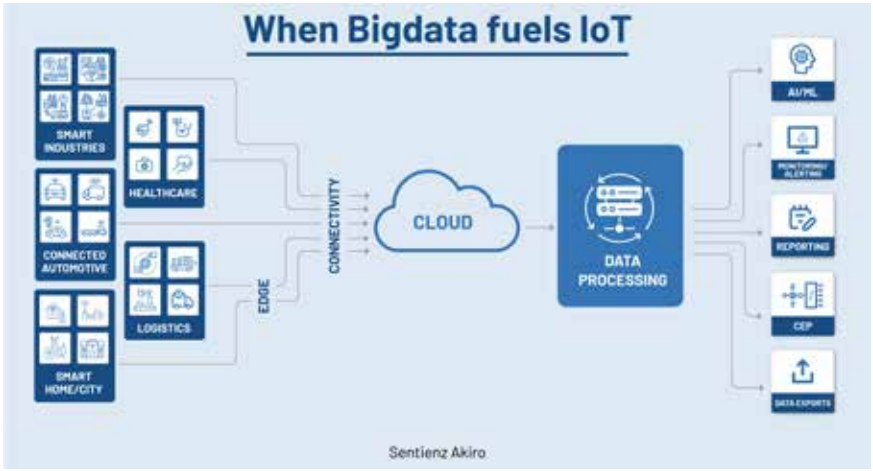
With these questions answered, it will be easier to formulate the data strategy for your IoT system.

Finalizing these fundamental requirements are very important and might take from weeks to months. But this strategy must be extensible to accommodate your business expansions in the future.

Important aspects

Connectivity and QoS

With the devices on the field and a variety of devices speaking various protocols like



IoT with Big Data

MQTT, Websockets, Lorawan, Zigbee, bluetooth, connectivity forms the core of the IoT platform. The connectivity is managed at the edge for edge local protocols and some devices directly connect to the cloud with IP based protocols like MQTT and Websockets.

Since the devices use a wide range of connectivity from 2G to 5G and portable devices remain in motion, devices often use flaky networks to communicate with the cloud. With these flaky networks and frequent network glitches, the Quality Of Service (QoS) is very important to be maintained during the message exchange between the cloud and the Edge/Device. Some IoT protocols like MQTT ensure the QoS with various delivery guarantees to ensure reliability of message delivery even in flaky network conditions. Following are the 3 QoS levels ranging from 1 to 2:

- 0 (ATMOST_ONCE)
- 1 (ATLEAST_ONCE)
- 2 (EXACTLY_ONCE)

Edge data analytics

IoT Edge systems help in de-centralizing the data processing from cloud to on-premise devices. Edge can be a small device with 500KB memory to as big as a Desktop with 8GB memory. Edge data analytics will ease the IoT ecosystem in several ways.

1. **Data local decisions:** Faster response time on critical events by avoiding dependency on the cloud and network for important decisions which can be taken locally. Edge devices play a very crucial role in events like a car accident, where response time is mission critical.
2. **Local data aggregations:** Reduces the raw data being sent to the cloud and saves network bandwidth and cloud load. The aggregations can be dynamic and cloud can push aggregation policies to the edge dynamically.
3. **Consistent uptime:** Avoid higher dependency on the network or cloud and avoid the system downtime when either of these are affected.
4. **Data security:** Avoid sending sensitive data over to the cloud with local decision making. Edge devices can also do data masking, which is masking of PII data before sending to the cloud.
5. **Crucial:** For off the grid IoT systems like Oil fields, remote installations.

Since the edge systems have smaller computing power, edge data analytics and processing must be used judiciously.

Data analytics stages

Once the data is in cloud, the data needs to go through different stages

1. Data Validation and Filtering - Filtering the invalid data and avoiding corrupted data entering the system. Filter only the chosen data streams to be processed in the next stages.
2. Data enrichment or Preprocessing - The raw filtered data is enriched with various information like replacing zip codes in the data with richer location information, adding complete user information based on the user IDs. This process is also called data flattening, where all the necessary data for analytics is pumped into the record, hence avoiding any joins in the later stages.
3. Data processing - All the business logic is applied in this stage and this is generally the most complex one. Based on the need for the real time-ness of data, Data processing can be categorized into real time processing, batch processing and Lambda processing.

Data processing

Real Time processing is for time critical responses and reports. Real Time alerting for vehicles crossing its geofence area or a machine vibrations crossing a threshold are some of the examples. Realtime reporting is required for use cases where business needs to see what's happening at realtime, like location tracking of automobiles. Real Time processing is generally quick,the analytics or alerting is expected within a few seconds or minutes of the data generation at the device. Frameworks like Apache Flink, Apache Storm, Spark Streaming, Heron help in real time processing.

Batch processing is for more time taking or complex processing. This might include deeper, more accurate analytics. Like trends and analysis across various time periods, anomaly detection, rule based models, data preparation for machine learning models. In real time processing, preference is given for speed rather than accuracy while in batch processing, accuracy is given more precedence. Frameworks like Apache Spark, Apache Tez help in batch processing.

Lambda processing Generally the processed data for realtime and batch would be separately consumed by the consumers. Lambda is a hybrid approach, where the realtime processed data is augmented with the more accurate batch processed data. Hence the user gets a wider view of realtime and batch data at the same place. Frameworks like Apache Druid, Pinot by Linkedin help in Lambda processing.

Complex event processing (CEP)

The processing of data can soon get very complex with the different incoming data streams, a variety of actions available on the data and different processing preferences for stakeholders of the data. With self-serve CEP platforms like Sentienz Akiro IoT, the control can be given to the business users to easily create what they want to do with their data. Below is a sample CEP pipeline created by one of the users.

Making the platform self-serve is very important for the scalability of your IoT

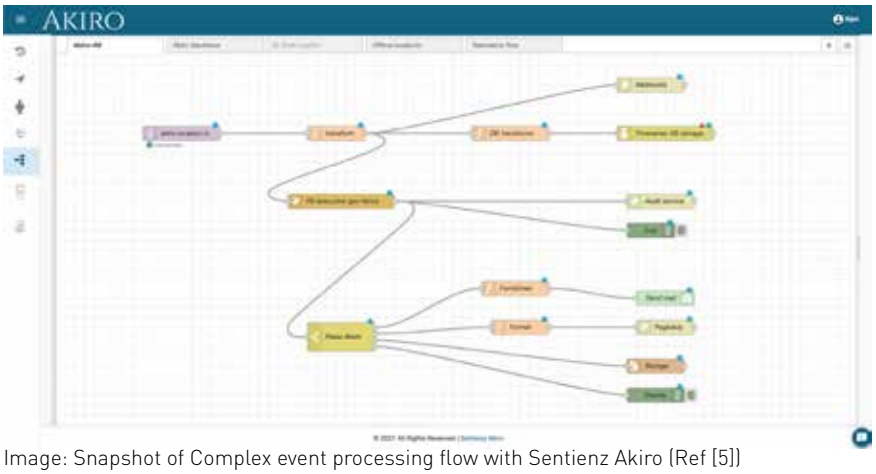
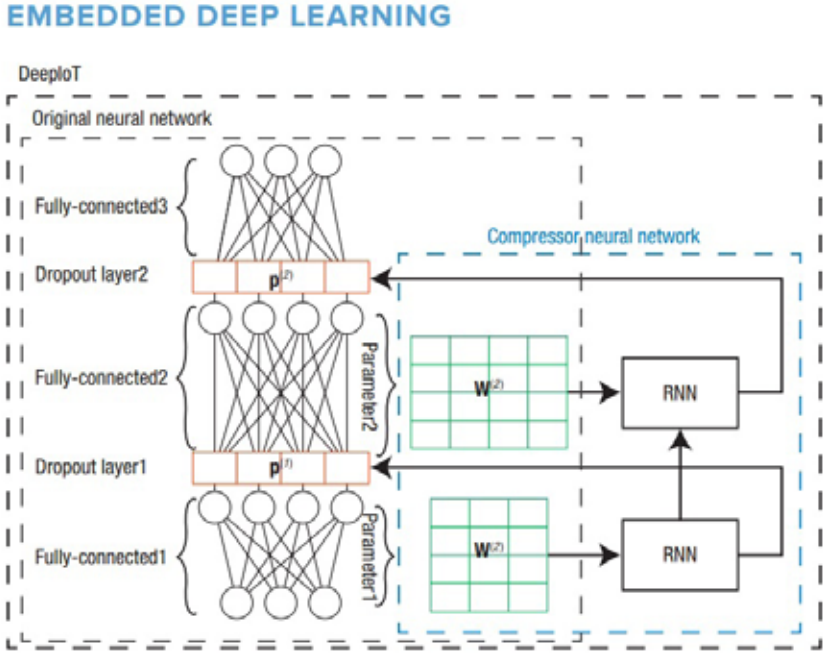


Image: Snapshot of Complex event processing flow with Sentienz Akiro (Ref [5])



deep learning compression algorithm, called DeeploT (Ref [6])

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solution. Different stakeholders of the data can manage their data and create pipelines and reports easily. It would increase the adoption of your IoT data many folds.

Machine learning and Deep learning

This is one of the main value additions from an IoT platform which can be an article by itself. Machine learning can detect patterns in the data which otherwise might be very difficult to figure out like anomaly detection, predictive maintenance and optimized energy consumption recommendations.

Deep learning is the next frontier of machine learning. Deep learning imitates human learning with Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN). These were earlier used in image pattern detection and processing and now are being used on IoT sensor data as well. Deep learning can detect advanced patterns, help in video and audio processing and also aid in advanced decision making like Autonomous cars, and use cases like intrusion detection, recognising human behavior, power demand forecasting, Path planning.

Conclusion

Big data and IoT are 2 behemoths. When these 2 combine, the possibilities are immense. And they need to be planned and executed meticulously, else things might get messy very soon, especially with the scale and the complexity of the platform. Based on our experiences in IoT and Bigdata, this article is a small attempt to help businesses for easier onboarding onto IoT and Bigdata.

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Journey from Telematics Platform to Connected Platform

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In the automotive industry Telematics, especially general purpose Track & Trace (T&T) applications has come a very long way from pure Track & Trace applications to complex Integrated Vehicle Health Management (IVHM) platform fueled by Advanced data analytics. This is in line with industry's focus on connected, electric vehicles and autonomous vehicles with various degrees of ADAS projects undertaken by the industry. But these developments present a unique challenge for enterprises running legacy or Third party telematics systems.

Questtion#1: Journey from Track & Trace to Connected Platform:

How can organizations seamlessly transform the already running legacy telematics systems architected to serve T&T requirements to connected, electric and autonomous use cases which requires pumping millions of data points every second and requires much faster data processing and decision making capabilities either at cloud or at edge.

Question#2: How do we securely achieve the same

How do we securely achieve this transformation, especially with maturity of hackers and their attacks grown multifold over the years, making the existing T&T platform more secure and robust from cyber-attacks remain one of the top most challenge

An Approach

Like any other situation, there are multiple technical solutions to achieve the above objectives. In this article however, we will be focusing on one achieving the same using the traditional Track & Trace Platform

Track & Trace Platform

Conventionally speaking a Track & Trace Platform is used by organizations for basic Track & Trace operations, trip usage analysis, route analysis. The typical characteristic of a conventional T&T Platform is

- Monolithic Design
- Virtual Machines Based
- RDBMS

Integrated Vehicle Health Management(IVHM)

Integrated vehicle health management (IVHM) is the unified capability of systems to assess the current or future state of the member system health and integrate that picture of system health within a framework of available resources and operational demand. IVHM requires a holistic approach and deep integrations with Original Equipment Manufacturer (OEM)'s ERP & IT Systems.

- Microservices driven
- Containers based deployment topology
- NoSQL /Data-Lake
- Native API Support
- Native Data Streaming Support

Transformation Approach

We propose a two-step process to achieve this transformation. This transformation is powered by an open source and open standards-based framework to support transformation of the legacy Telematics platform to a complete IVHM stack in line with ongoing business demand.

Step#1: First a brownfield step in which a data analytics/digital enablement platform (DEP)/layer can be plugged into an existing Track & Trace platform. This step can help OEMs serve its existing customers and at the same time will help them in processing the real time Telematics data to find actionable insights which is the bedrock of a IVHM.

This DEP platform will have the capability to ingest data into a data lake via traditional Message queues as well as more modern Kafka streams.

- By following an ELT (Extract- Load and Transform) design paradigm rather than more traditional ETL (Extract Transform and Load), data in as-is format can be stored in the Integrated Data Lake.
- Post which Automotive ready algorithms in Kubernetes Container Management platform can help find deep actionable insights in a very efficient manner.
- This information can then be made available by API Management platform/Frameworks such as Django/WSO2/IBM API Connect/ AWS API Gateway etc.

Step#2: In the second step the message queues and web services endpoints at ingestion layer will be replaced by a Kafka Broker and Telematics Control Unit (TCU) lifecycle management can be taken care by HSM backed Device management platform.

- TCU devices with HSM Modules can be managed by a Device management platform which has at a bare minimum certificate based support for device onboarding. In this case Key management becomes very important and aspects such as key rotation etc. This will securely enable ingestion of data points directly into the data lake after device and endpoint authentication and authorization.

Why Kubernetes?

Kubernetes, also known as K8s, is an open-source system for automating deployment, scaling, and management of containerized applications.

It groups containers that make up an application into logical units for easy management and discovery. Kubernetes builds upon 15 years of experience of running production workloads at Google, combined with best-of-breed ideas and practices from the community.

Even though there are many container orchestration platforms available but Kubernetes has become the de-facto standard for container management system as it offers several advantages:

The ease of scaling is amazing as the autoscaler service can replicate Kubernetes instances or pods to different nodes, thereby maximizing resource utilization.

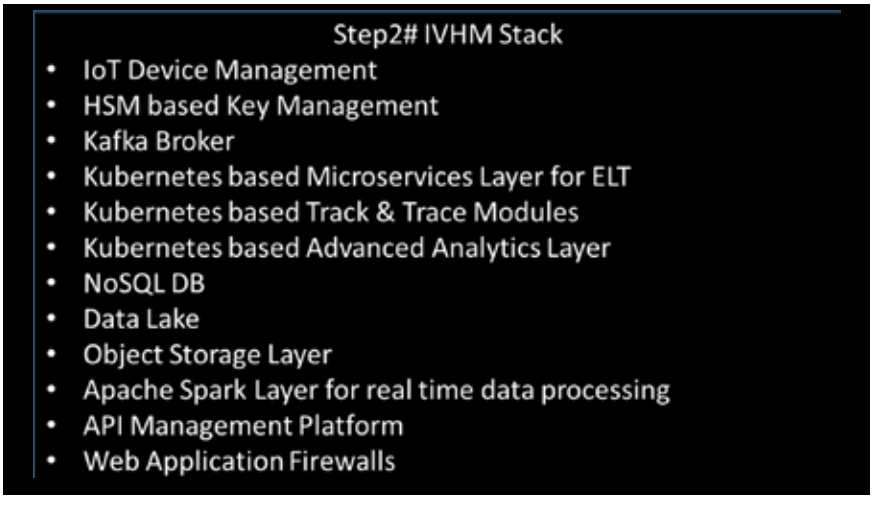
Since K8s is an open source platform, the software can be easily ported between different types of environments.

Kubernetes offers high fault tolerance clustering, which contributes to the stability and reliability of the project.

It has built-in data encryption, vulnerability scanning, and other capabilities that enhance its safety.

With Kubernetes, developers can maintain replica sets. No need to replicate the entire application, making the project more resilient and have maximum responsiveness and uptime.

- **Apache Kafka**
  - Apache Kafka is used for real-time streams of data, to collect big data, or to do real time analysis (or both). Kafka is used with in-memory Microservices to provide durability and it can be used to feed events to CEP (complex event streaming systems) and IoT/IFTTT-style automation systems.
- In parallel other Data sources such as Enterprise Resource planning data (ERP, Customer Relationship Management (CRM) Data, other Historical Data can be pointed to the Integrated Data lake.



Data Lake

A data lake is a centralized repository that allows you to store all your structured and unstructured data at any scale. You can store your data as-is, without having to first structure the data, and run different types of analytics—from dashboards and visualizations to big data processing, real-time analytics, and machine learning to guide better decisions.

- **Apache spark**
  - Apache Spark is an open-source, distributed processing system used for big data workloads. It utilizes in-memory caching, and optimized query execution for fast analytic queries against data of any size. It provides development APIs in Java, Scala, Python and R, and supports code reuse across multiple workloads—batch processing, interactive queries, real-time analytics, machine learning, and graph processing.
  - After which more advanced correlation analysis can be run by augmenting (as additional data is now available) the already running models hosted in containers. Once mature the legacy T&T application can be sunset.

- **API Management Platform**
  - The telematics data such as location data, vehicle health data can be made available with various stakeholders such as ecommerce companies, fleet management operators, load aggregators, Government authorities etc. via APIs. We propose a complete API Management platform to manage the API lifecycle for all the APIs

- **Object Storage Layer**
  - Object storage layer can be used for data storage as well as data archival. Object storage can be used as OLAP layer.

API management is the process of designing, publishing, documenting and analyzing APIs in a secure environment. Through an API management solution, an organization can guarantee that both the public and internal APIs they create are consumable and secure. Some of the key components of API Management platform are:

- API designer
- API gateway
- API store
- API analytics

A WAF protects your web apps by filtering, monitoring, and blocking any malicious HTTP/S traffic traveling to the web application, and prevents any unauthorized data from leaving the app. It does this by adhering to a set of policies that help determine what traffic is malicious and what traffic is safe. Just as a proxy server acts as an intermediary to protect the identity of a client, a WAF operates in similar fashion but in the reverse—called a reverse proxy—acting as an intermediary that protects the web app server from a potentially malicious client.

- **K8S based Track & Trace Platform**
  - The legacy Track & Trace application can then be migrated to the Kubernetes Container management platform.

- **Web Application Firewall**
  - Web application firewall will help protect both the track & trace platform as well as the APIs

Rest of the Architecture will remain as is.

Benefit

This framework can not only help Automotive companies accelerate their Data Monetization Journey but can also help in securing legacy Telematics platform, historical data (both in transit as well as at rest), an accelerated journey to support Streaming Data, Big Data, Containers, Unstructured Data, Data Lake etc. This will also benefit Automotive enterprises achieve faster go to market for various connected services such as Usage based insurance, Fleet as a service, Warranty Analytics etc. ❑

AUTHOR

AJAY TIWARI
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VOLVO EICHER COMMERCIAL VEHICLES

I am currently leading the Connected Services portfolio in Volvo Eicher Commercial Vehicles Limited and taking care of Open Source Open Standard Enterprise Architecture, IoT/IIoT Deployments, Partner Integrations etc. I have over 12 years of experience in complex Product Design and deployments covering Automotive, Telecom, Manufacturing etc. and have overseen almost complete IoT & IIoT Value chain deployments ranging from Device to Data Engineering. I have done my MBA from IIT Delhi and B.Tech in Electronics & COMMUNICATION FROM GGSIPU, DELHI.

MIPI Alliance releases in-vehicle "display stack" interface specifications

The MIPI Alliance announced the completion of its MIPI Automotive SerDes Solutions (MASS) "display stack," a set of interface specifications designed to streamline display integration and support the growing bandwidth and functional safety demands required by the increasing number of high-performance displays used in next-generation vehicles.

The new specifications build upon MIPI A-PHY, is asymmetric SerDes interface, as well as display protocols MIPI Display Serial Interface 2 (MIPI DSI-2) and VESA Embedded DisplayPort and DisplayPort (VESA eDP/DP), to create long-reach source-to-sink connectivity between automotive displays and their associated electronic control units (ECUs).

The new specifications that complete the display stack are:

- MIPI Protocol Adaptation Layers (PALs) for MIPI DSI-2 and VESA eDP/DP, to allow display components based on these protocols to map their video, audio and control data to A-PHY's A-Packet format for transmission over long-reach MIPI A-PHY networks
- MIPI Display Service Extensions (DSE) v1.0, providing functional safety enablers and support for High-Bandwidth Digital Content Protection (HDCP)
- MIPI Display Command Set (DCS) v1.5, an update to the standard command set for MIPI DSI-2

The completion of the display stack is a step in the creation of the overarching MASS framework, which will provide a standardized, reliable, long-reach connectivity framework for automotive image sensor and display integration with built-in functional safety and security enablers. For displays, it supports point-to-point and daisy-chained topologies, as well as heterogeneous displays, and its use cases include lane-keep assist displays, "virtual" side-view mirror and backup camera displays, as well as co-pilot infotainment displays and others.

MIPI DSE v1.0 standardizes functional safety enablers within display solutions to help designs meet ISO 26262 requirements from ASIL B to ASIL D. These enablers include link failure detection, timeout monitoring, cyclic redundancy check (CRC) to detect data transmission failures, and a message counter for replay protection. HDCP is also enabled by DSE v1.0, and additional security features will be added through future DSE releases and upcoming MIPI security specifications.

A new version of MIPI DSI-2, v2.0, with updates to include video-to-command mode transition, adaptive refresh panel, and the latest VESA Display Stream Compression (DSC) and Display Compression-M (VDC-M) codecs, is scheduled for release midyear 2021. ❑

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Blockchain: the new driver of innovation for the automotive industry

ANUPAM BHATTACHARJEE, SWAPNIL KULKARNI
Tata Technologies

In the late 19th century, the modern automotive originated in Europe with the invention of 'The Three-Wheeled Motorwagen' by Karl Benz. During the initial period, cost and production time were key deterrents for mass uptake of cars. However, in the same decade, Henry Ford pioneered the mass production of cars with the invention of the assembly line. Model T was the first mass produced vehicle, which was affordable and accessible to the general public.

Automotive innovations have underpinned the growth of the automotive industry in the last century. However, innovations have reached stagnation in the recent times due to the increased focus of original equipment manufacturers (OEMs) on honing existing technologies rather than raising stakes on disruptive changes. However, with the advent of autonomous, connected and electric technologies, the automotive industry has now become the hotbed of major innovations. Some of the major innovations that have radically transformed the industry include on & off-vehicle technologies such as touch screen human-machine interfaces (HMI), knobless actuators, phone apps, precise navigation, in-car entertainment services, onboard e-commerce, and seamless charging infrastructure. Concomitantly, OEMs have focused on developing cars that are software-controlled rather than hardware-driven. Moreover, innovations such as shared vehicles, ride-hailing services, etc., which were considered futuristic a couple of decades back are realities in the current times. Furthermore, automakers are increasingly branding themselves as mobility service providers rather than just manufacturers and sellers of cars.

Although the automotive industry may seem resilient and steady for an onlooker from other industries, but the industry is fraught with challenges due to disruptions created by unicorns like Tesla, NIO, Rivian, and Lordstown Motors. In the current times, automotive brands like Tesla have been valued at three times that of traditional OEMs like Toyota with only one-twentieth the sales volume of Toyota. This essentially explains the underlying cause of the valuation difference of industry occupants, i.e., the technology maturity gap, which is also perceived by industry proponents as an indicator of a technology revolution.

The million-dollar question that intrigues us is 'What are these changes?'. To answer this, we need to take a explore the cosmetic and radical changes that have occurred in the industry. Taking a closer look, one can find that the industry stakeholders are only inclined towards technological changes in cars but also inducted new business models to carve a niche for themselves in the industry. Some of the radical transformations that have redefined the industry outlook include 1. Rise of ridesharing & car leasing 2. Advent of mass-market electric vehicles (smart mobility solutions), and 3. Evolution of smart, connected, and self-driving cars.

The industry, however, needs a robust enabler to continue its momentum, especially considering the fact that the new automotive ecosystem is mammoth with the presence of multiple stakeholders such as customers, automotive OEMs, government agencies, third-party service providers, dealers, among others. With such complexities lurking in the industry, transaction transparency, information (data) management, and collaboration with various business partners have caught the attention of the industry players. Moreover, a trustworthy technology backbone is pivotal to accelerate the implementation of new business models.

"Fifty-six percent of OEMs and 52 percent of suppliers agree that the blockchain investments their companies choose to make will be highly influenced by the opportunity to develop new business models." – IBM

Mobility-as-a-service (MAAS), usage-based models, and other innovative variations of mobility require:-

a. Information sharing
b. Financial payments
c. Participant authentication
d. Transaction tracking

There is a pressing need to have seamless, secure, and immutable interaction among mobility service providers, consumers and vehicles.

Which technology is better suited to do this?

The data gathered by vehicles & mobile applications using build-in sensors and third-party retrofit solutions hold tremendous potential for the benefit of all stakeholders. The data can be leveraged to develop new business models to reduce costs and deliver superior customer experiences. Technologies such as AI, big data, and IoT combined with blockchain are set to create a huge impact and present opportunities to the automotive industry stakeholders.

On the other hand, as per General Data Protection Regulation (GDPR), either vehicle owners or drivers have the right of self-determination and disposal of personal data generated in the car. In

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the past, OEMs had the notion that the data stored and transmitted by vehicles into their systems is attributed only to the vehicle rather than the driver-related data, precluding the driver from accessing the data. Moreover, lack of clarity on GDPR has resulted in a legal grey area. Thus, there is a need for:-

a. manufacturer-independent standards and vehicle data platforms for general and regulated access to the data
b. a data-storage system that is transparent, immutable, secure, managed access as per the law of the land.

Lately, technology startups and technology moguls have been inclined towards disruptive and challenging methods of conducting business. This can be understood by the fact that

1. Tesla is now almost five times more valuable than Volkswagen and has a market cap of more than seven times higher than that of GM and 14 times higher than that of Ford Motor Company.
2. Uber, a ride-hailing company is worth more than Ford Motor, General Motors, and Fiat Chrysler.
3. Technology companies like Google & Apple have invested significant amount of efforts. For instance,
   a. Google launched its Waymo division to develop and market consumer-ready driverless vehicles worldwide.
   b. Apple is working on a self-driving car technology for passenger vehicles, which is planned to in mass production by 2024

Automotive OEMs and technology companies are now facilitating the enablement of real-time car monitoring, auditability, and scalability. These factors could fuel the adoption of blockchain technology towards vehicle connectivity, cybersecurity, and autonomous running. Furthermore, mobility, supply chain logistics, retailing, leasing, smart manufacturing, connected living, IoT, and connected insurance are several long-term functional areas for automotive OEMs that can be revolutionized by blockchain technology.

Blockchain is the latest buzzword within the automotive industry. Over the last few years, this was used to transact cryptocurrencies such as Bitcoin. Research on blockchain and its applications in the automotive industry is still at a nascent stage. With prevailing unfamiliarity of its potential benefits, this technology is still struggling to make inroads among the masses. Moreover, shortage of skilled blockchain developers and dwindled investment on this technology have been attributed to its below par adoption. However, this technology can solve some of the significant challenges of the automotive industry, such as vehicle-to-vehicle (V2V) communications, secure data transactions, location tracking, and serve as a reliable gateway to new services like ride-hailing, autonomous vehicles, etc. The silver lining in the cloud is that the current trend of rapid disruptions in the industry can spur the adoption of blockchain.

What is Blockchain?

Blockchain is a decentralized public network that allows people and companies to store and transfer information and currency securely & instantly. The term blockchain refers to storing data in" blocks" of information and then linking them together in a permanent "chain". When a new block is added to the chain, it makes the previous blocks even harder to modify, which helps each block become more and more secure over time. Several facets of blockchain technology make it unique and valuable for various strata of the automotive business applications.

There are three essential parts to every blockchain: -

Record: This can be any information.

Block: A bundle of different records.

Chain: This contains all the blocks linked together.

The basic principle on which the blockchain works is elucidated below:

Why blockchain in the automotive industry

In blockchain, almost any document or asset can be expressed as a code and referenced by a ledger entry, which fundamentally means that blockchain technology has vast applicability. Some of the fundamentals on which blockchain works are as follows:

Immutability - It is almost impossible to make changes to the blockchain without detection, thereby increasing confidence in the information it carries and reducing chances of fraud. Once the data is created and stored, it cannot be edited or deleted, i.e., a ledger cannot be changed or altered.

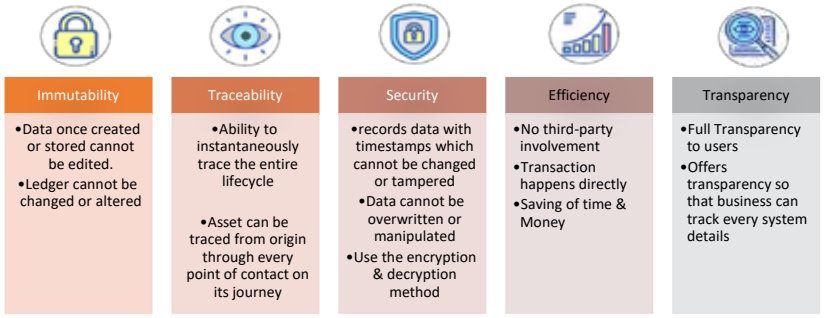
Transparency - Transactions are visible to all participants, with identical copies maintained on multiple computer systems, which increasing the ability to audit and trust the information. Additionally, it can track every system detail.

Security – It uses encryption and decryption methodologies. Data once recorded with a timestamp cannot be tampered or changed. Additionally, once the data is stored, it cannot be overwritten or manipulated. As multiple participants share a blockchain, it has no single point of failure and is resilient in the face of outages or attacks.

Efficiency – As there is no third-party involved, transactions happen directly, which results in saving of time & money.

Near-Realtime - The settlement of recorded transactions happens almost instantaneously, removing friction and reducing risks.

Whether it is assembly-line production, advancements in combustible engine (CE) technology or introduction of autonomous and connected cars, the



automotive industry has a history of turning every challenge, every adversity, into an opportunity.

The last few years have been particularly tough for the industry. Stricter regulations, supply-chain disruptions due to trade conflicts, a host of such challenges among others have impacted the growth curve of the industry. Then, the onset of the pandemic was affected it adversely, making it among the worst-hit sectors.

True to its grit, the automotive industry has responded to these challenges by bringing out the big guns of innovation during the last few years in product offerings, superior customer experience and efficiency improvement to save cash during the most challenging economic situations. On & off-car digitization is playing a pivotal role in the growth of the automotive industry. The on-car digitization includes vehicle connectivity (V2X), entertainment, turn by turn navigation, onboard e-commerce and a host of 3rd party services. There will be several apps available in the car operating system, which will drive many use cases for every need of customers. The home/office automation IoT ecosystem will get dovetailed to the car OS to create a seamless experience spanning customer's daily life. These changes will lead to better utilization of cars and fuel the need for these convenience systems in the next-generation cars.

The off-car digitization will encompass the management of the cradle-to-cradle journey of the customer. The OEMs will drive this at all their touchpoints, both offline & online. The complete seamless and personalized car buying experience at the convenience of sitting at home is already the focus of digitization today. The other important area of digitization will emerge in the post-sales service, supply chain, regulator compliances, recall management and asset management, etc. These collaborative convenience features will drive the growth of the automotive industry, and what best technology framework apart from blockchain can support this kind of multi-stakeholder ecosystem of trust. With blockchain, we can improve quality, reduce cost, eliminate waste, and predict problems. Blockchain will enable greater transparency and trust within the ecosystem.

Hence, everyone in the automotive industry is exploring the first significant blockchain innovation. The most awaited innovation can create a compliance and conformity traceability platform for the entire automotive industry.

Blockchain use cases – Automotive Industry

So, should blockchain be a priority for the automotive industry? The automotive industry is heavily investing in autonomous driving, ridesharing, battery electric vehicle, on/off-car digitization, etc. Should they now be redirecting a portion of their research budget toward a technology that is still at a nascent stage? We have examined that question subsequent sections .

But before we go any further, we should take a closer look at what we have understood about blockchain. In a nutshell, it is a technology that enables secure decentralized transactions with few or no intermediaries. Blockchain is based on a decentralized database, transaction history, a consensus mechanism & an automated digital contract execution in which transactions between participants happen and recorded. Every transaction on the blockchain is recorded forever, and any attempt to tamper with, steal or falsify any record is immediately highlighted. The blockchains themselves do not store the information rather, they record the proof of the transaction, known as the transaction "hash".

It is this unmatched security that creates blockchain relevant for the transaction that needs an audit trail. Blockchains are extremely difficult to break. To hack a blockchain, one would need an unrealistic amount of computational power. This technology, therefore, grants universal proof of anything that has occurred and has been recorded.

Since early 2017, a growing number of automotive manufacturers have been developing proof of concepts for blockchain technology to become forerunners in the technology. The Mobility Open Blockchain Initiative (MOBI) launched in May 2018 aims to accelerate the adoption. But the question is, where and how should automakers, suppliers, dealers and customers, be involved in blockchain? Let's find out.

Let us consider a classic example of Agriculture. Agriculture accounts for 16% of India's GDP (12+ crore farmers engaged in agriculture). India has the second largest arable in the world but individual land ownership is minuscule. Buying farm equipment for such lands is unviable. Farmers suffer on two accounts: 1. They cannot afford farm equipment, and the yields remain low as manual farming is inefficient. Now, how can blockchain help here. Blockchain is an ideal platform that can create an ecosystem like Uber for tractors or earth-moving equipment. We may make fractional ownership of the machines using blockchain. The smart contract can facilitate many farmers to own a single tractor or earth-moving equipment, which is more accessible and will have a fraction of the cost impact on the farmers. All the financing and other complications that arise during the transaction can be managed efficiently using blockchain.

In the fraction ownership blockchain example, we can see that the same concept may work well for car leasing, ride-hailing, autonomous driving, and so on. Some of the recent live blockchain use cases have been enlisted below to better understand the applicability of blockchain in the Automotive Industry.

• Automotive financing
The Indian-based OEM created a blockchain incubator focused specifically on the automotive financing portfolio. The products are aimed at small- and mid-sized enterprises that are clients with Mahindra Finance in the Indian market.

• BC Mobility & Logistics (Blockchain solutions GmbH)
BC-based transportation smart-key solution built on data generated by smart devices can record driving data & manage car-share transactions including transactional access rights), monitor vehicle information for car-related business cases (insurance, DOOH advertisement, car rental, car reports) on integrated infrastructure.

• Blockchain-enabled tollbooth (Oaken Innovation)
Idea/test in which Tesla cars automatically pay as they pass through toll booths, as both nodes (car and tollbooth) have Ethereum nodes, which use smart contracts to trigger a machine-to-machine (M2M) transaction.

• Toyota
Toyota Motor Corporation along with Toyota Financial Services Corporation unveiled its Toyota blockchain lab on March 16, comprising six Toyota Group companies. The Toyota lab explores what the future of the automotive industry may look like. The blockchain lab has been examining the potential of blockchain technologies. The group now seeks to accelerate initiatives towards business implementation and expand strategic partnerships outside the group. The sole objective of Toyota's almost year-long foray into blockchain technology is to shift the group's focus towards becoming a more holistic mobility company that provides a wide-ranging transportation-related platform. To achieve this, it intends to use blockchain to develop an environment in which users can connect more openly and securely with the companies that provide them with services. Toyota blockchain lab has been reportedly carrying out investigative studies and undertaking trial projects, the phase of which was completed in November 2019 mainly use of applications in the areas of customer and vehicle verification along with supply chain monitoring and digitization of assets to diversify its range of available financing methods.

• Volvo
"With blockchain technology, we can take the next step in ensuring full traceability of our supply chain and minimizing any related risks, in close collaboration with our suppliers," said Martina Buchhauser, Head of Procurement, Volvo Cars.

Volvo Cars will become the primary carmaker to implement global traceability of cobalt utilized in its batteries by applying blockchain technology. Traceability of raw materials utilized in the assembly of lithium-ion batteries, like cobalt, is one among the key sustainability challenges faced by carmakers. Volvo Cars enabled full traceability, ensuring that customers can drive electrified Volvos with the batteries sourced responsibly. Blockchain technology, which establishes a transparent and reliable shared data network, significantly boosts transparency of the raw material supply chain as the information about the material's origin cannot be changed.

• Volkswagen
Volkswagen is currently testing on a mileage clocking system that makes it hard to alter odometers, helping the used car market become more transparent and secure. Therefore, the used vehicles retain better value. Customers can permanently save their odometer readings via a classy system that cannot be changed retroactively without somebody noticing that they need been manipulated.

• Hyundai
Hyundai MOBIS, the company's spare parts subsidiary, has launched a replacement MAPS (Most Advanced Parts System) software platform that uses blockchain to distribute aftersales parts for 300 of its Hyundai and Kia brand cars.

The system will support inventory and distribution planning of around three million parts along with authentication, predicting demand and tracking 65 million units per annum across 200 countries in Hyundai's sales network.

The system will be used by around 100,000 people, including 35,000 parts distributors and maintenance shops and 16,000 dealerships for "parts purchase, logistics, and quality control." Blockchain technology is being applied as a pilot for product authentication.

• BMW
The BMW Group uses blockchain technology to ensure the traceability of components & raw materials in multi-stage international supply chains. The "Verify Car" project initiated by BMW in partnership with the blockchain platform VeChain consists of a Vehicle Digital Passport. Verify Car will add more transparency when users want to check the history of their BMW cars.

• GM
General Motors has used blockchain to enhance the current navigation system. Blockchain-based in-car navigation system will share a load of knowledge collected when the cars are driven in the city. The data collected via this blockchain technology in real-time will then be working with discrepancy detectors that check the incoming data with existing maps.

Any difference detected will then be transmitted to the blockchain network and can be cross-checked if an identical pattern has been observed by other moving vehicles.

Additional Use Cases:

• Automotive title transfer
To streamline the process of transferring ownership from buyer to seller of a car by digitizing and securing titles, expediting the time needed to authenticate, validate, and transfer ownership of specific assets.

• Supply chain management
It will enable more transparent and accurate end-to-end tracking in the supply chain. Organizations can digitize physical assets and create a decentralized, immutable record of all transactions, making it possible to track purchases from production to delivery or use by end-user.

• Smart manufacturing
Blockchain may be utilized for on-demand

manufacturing, smart prognostics, inventory management, and resolving ownership issues.

• Insurance & insurance claim processing

To provide bespoke insurance offers & premiums and streamline both claims processing (documentation, submission, review resources, verification) and subsequent pay-outs and service contracts associated with financing and executing repairs.

• Loyalty based microtransactions/ infotainment

Reward programs to drive customer engagement, retention, and additional revenue across a variety of sectors. Provide a valuable add-on to infotainment technology by ensuring that in-car payments for movies, apps, and other services are kept secure.

• Automotive financing process

To streamline the loans and financing processes (customer bank validation and transaction setup & execution, issuing letters of credit, reviewing multiple documents sourced from different locations, scoring & classifying risk, and archiving of reviewed documents).

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TELTONIKA DUALCAM

PROS: HD VIDEO QUALITY, 170-DEGREE VIEW, EASY INSTALLATION, AUTO EVENT CAPTURING

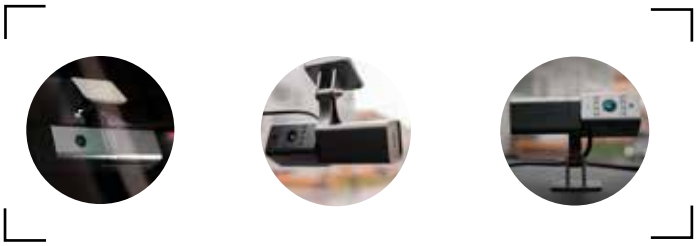
CONS: NO LCD SCREEN, 4K NOT AVAILABLE

OVERALL: ★★★★½

Telematics Industry in India is seeing a boom, the market growth is not only exponential but also sustainable. The fleet owners are getting more and more aware and educated about the possibilities to monitor, secure and protect their fleets in the best possible ways, and also saving significant money out of it. And to meet these expectations the engineers and designers keep raising the bar with new ideas and designs. Now with conventional methods at the back seat, the market competition has pushed innovation to the front seat. Telematics in definition has gone much beyond longitudes and latitudes one such innovation is dashcam.

Though the concept is not new, these cameras' viewing coverage capabilities are very limited. However, with Dual cams, this is no longer a challenge you can get almost a 360-degree view with current range of dashcams in the market. We tried few dual cams earlier too, and following all the news and hype, we recently tried Teltonika Dualcam which, in our understanding and experience, outperforms a lot of cameras currently available in the market. Kindly go through the review to make the best decision for yourself.

Teltonika Dualcam: With sturdy and long lasting built, its perfect for capturing videos or pictures of the events that might occur on the road, e.g., crash, theft etc. Mounted on the vehicle front window, with two cameras we get visibility on the roads and inside the vehicle to record videos before and after the events, it also takes photos periodically or by request and sends all data to the server.



Features: Right features are always important to make sure we meet our objective and get additional values from the product. With Dualcam, ability to have video record of your trip events; and to ensure safety of passengers or high value packages, reliability and features are deciding factors. Dual Cam offered by Teltonika comes loaded with features, which ranges from must haves to much needed.

Teltonika made sure to cover almost all the features a dual dashcam should come with, I am sure a lot of effort went into R&D for this. Simultaneous recording from both Cameras, gives the driver's eye view and view inside the vehicle as well, which is very instrumental. High quality videos and fast video delivery with H265 coding is impressive.

Teltonika dual Cam offers you option to have up to 64 GB of storage and like two cameras you have option to use two micro-SD cards at the same time. This simple option was missing in the market, glad someone took a note of it. Day vision is colour while night is black & white. Installing the camera was very easy, you can do it either with sticky tape or screws. The wide viewing cameras cover almost everything around it, which is impressive given the HD video quality.

FEATURES:

- SIMULTANEOUS RECORDINGS FROM BOTH CAMERAS
- EXTENDED STORAGE UPTO 64 GB
- VIDEO BY DIGITAL INPUT EVENT
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QUICK REVIEW:

Performance:	★★★★★
Features:	★★★★★
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VERDICT: Finally a reliable Dual Cam with excellent performance is now in the market and with the proven confidence in the brand Teltonika, it's totally worth the money and the hype.

Artificial Intelligence in the Autonomous Vehicle

SUDHA JAMTHE
IoT Disruptions

Artificial Intelligence (A) is the hottest technology promising disruptions in every possible industry today. AI is powered by data. Hence, it is not a surprise that AI has begun disrupting the Automotive Industry and the much awaited promise of Autonomous Vehicles because the automotive has begun its journey to become software on wheels and is powered by data from the connected, autonomous vehicle. The data from the car powers the Artificial Intelligence in the vehicle. The mobility of the data in and out of the vehicle determines the type of Artificial Intelligence to be built. The choice of where the AI intelligence resides powers a variety of applications and takes care of the privacy and security questions that arise with data and AI. So to understand AI in the Autonomous Vehicle, it is important to track the journey of the automotive as it navigates through levels of autonomy aided by a wide range of Artificial Intelligence applications and how these applications are bringing the entire technology stack from the world of computers onto the automotive.

Connectivity Leads the Vehicle Towards Level 5 Full Autonomy

The connected, autonomous, shared and electric (CASE) model (see image1 below) is the most commonly accepted industry model for the path to full mobility. It was originally proposed by Mercedes-Benz. According to the CASE model the automotive becomes connected and electric to be offered to consumers using shared mobility, leading to full autonomy in the long run.

Image 1: CASE model for the path to full mobility

The CASE model has prompted Automotive OEMs to continue their journey in digitization of the vehicle by making all models of new vehicles with built-in connectivity with a built-in SIM with carrier connectivity with 4G or 5G where available.

SAE International published "SAE J3016" in 2015 and revised it in 2018 to describe 5 levels of vehicle automation from no automation to full automation. This has become the de facto industry standard following the adoption by the US Department of Transportation. According to SAE Levels, Level 5 is full autonomy where the vehicle can drive autonomously without human support in all road conditions. (See image 2 below)

Level 5 is the holy grail of full autonomous driving where the vehicle can drive autonomously without the need for a human to take control and it will work in all road conditions. Though every autonomous vehicle company is working to get to level 5, it is a technical challenge that is hard to solve because the Artificial Intelligence (AI) that powers the autonomous feature is a narrow AI that requires training data for specific road conditions to train for all possible humans, other vehicles and other things that would cross the path of a vehicle. This technology area is called perception space and it works by using computer vision for object detection and combines data from several sensors and cameras around the vehicle to get a picture of the road. Level 5 is technically not feasible today because

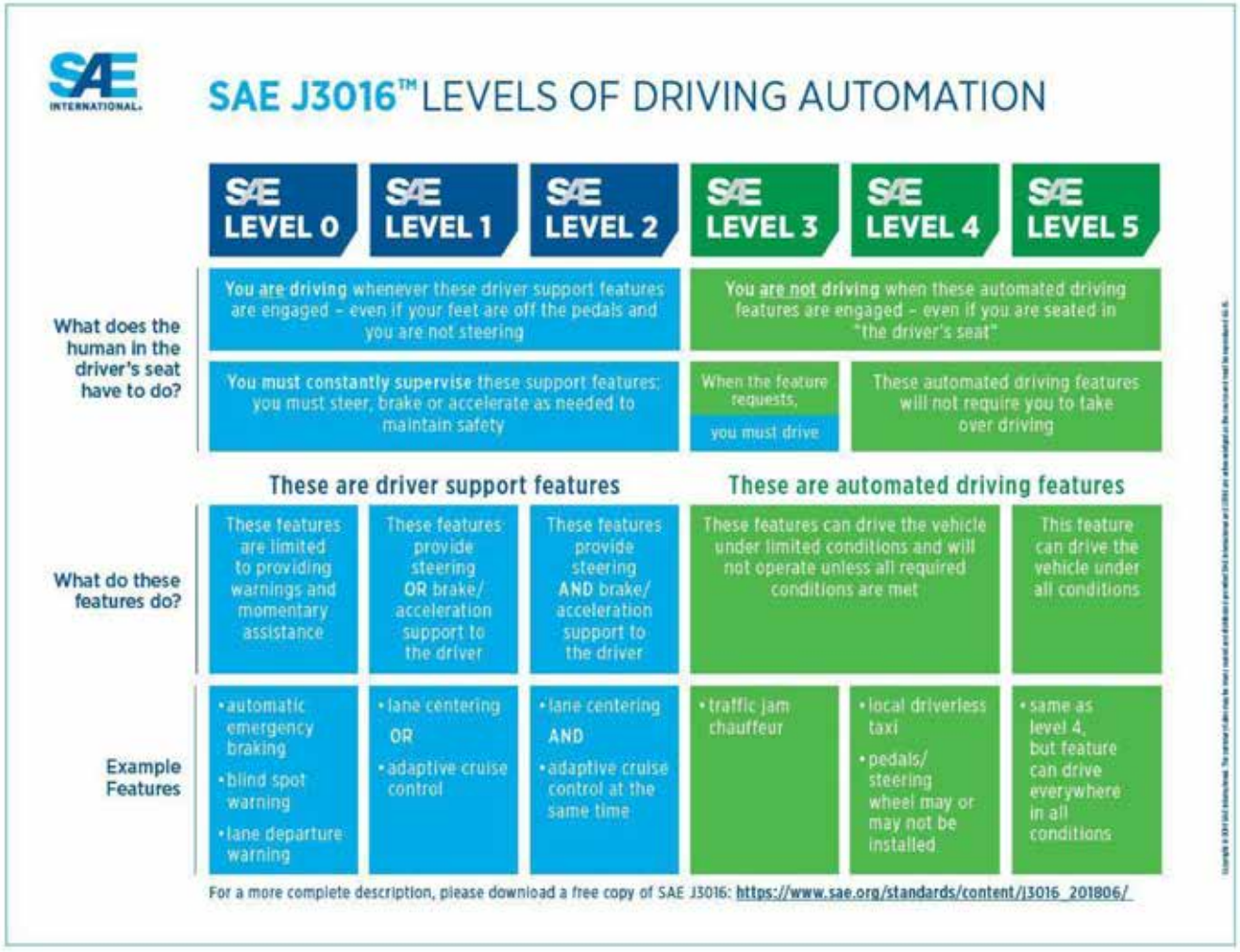

Image 2: SAE J3016 5 levels of Autonomy

of the need to train the autonomous vehicle for every road in every city in every weather and road conditions while planning for every possible object that could potentially cross the vehicle. AV companies are continuing to build Level 5 while testing new business models with Level 4 and sometimes with Level 3. Level 3 is where a human driver is required to be on standby to take control when needed. Level 3 and 4 are deployed in geofenced geographical areas where the autonomous vehicles are trained. Three business models that are being tested this way include robotaxis for consumer commute, freight delivery in autonomous trucks and middle-mile delivery of goods using small size autonomous trucks or delivery bots. Every one of these applications is powered by AI. Every one of them cannot be built without the support of the technology stack shifting to the vehicle.

The Autonomous Vehicle Technology Stack

The Autonomous Vehicle Technology Stack consists of two main categories of technologies. First is the new AV technology which is powered by sensors and computer vision to facilitate the actual driving. More important is that the entire technology stack from the desktop and mobile is transitioning to move to the vehicle as the car becomes autonomous to become a drive by wire powertrain.

I. Car Cognition Technology:

This includes four key modules:

1. **Sensor Fusion:** Cameras, GPS, Radar and LIDAR in the car bring data that are combined to inform the location of the car and what the car sees on the road at any given point in time.
2. **Perception and maps:** Perception is how the car sees the road. This is a map for AVs but more than that. Perception is about understanding the software to take sensor fusion data to make sense of its surroundings. For example, the AV needs to understand if the other vehicle on the front is moving towards it or away from it and understand its vector.
3. **Localization:** Localization is the technology by which the vehicle understands its location relative to the map of its environment. This is true for self-driving cars, or robots and other vehicles powered by autonomy such as AV trucks, autonomous tractors, autonomous forklifts and delivery bots. For the Autonomous Vehicle, or even the AV feature baked in an automotive as an ADAS feature, it is about knowing where the car is relative to the lane markers and other vehicles, shrubs, people and sidewalk. It is not as easy as getting GPS lat-long coordinates as it is used to do

motion planning and requires high precision more than the accuracy of a GPS. Localization techniques could measure the distance of the vehicle from every other object it sees in its environment. Another technique is to get a point cloud map of the environment and compare it to what the car sees as objects in real-time. Localization and perception are more about the processing power of this computation in real-time instead of which is a better technology approach.

4. **Drive by Wire Controls:** Path Planning and actuating control to the drive by wire brakes and accelerator is what allows the autonomous vehicle to move, stop or navigate the road to perform the actual driving.

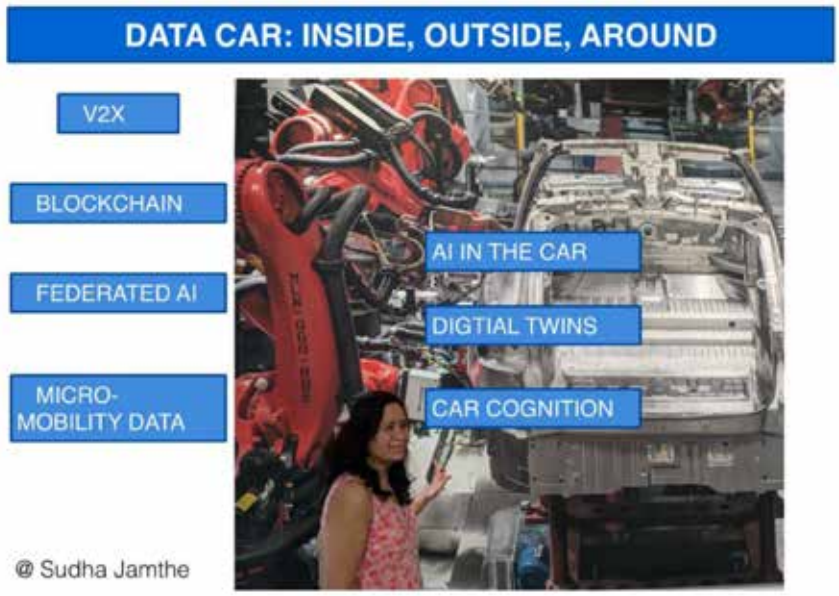

Image 3: Data in the Car and the AI it drives in-car and intra-car

II. The Software-on-Wheels Technology Stack:

These are the technology components that make the car into a software-on-wheels. We can look at them in the context of how they help the Autonomous Vehicle to support a variety of data science applications, connect to smart city infrastructure intra-car or create new design experiences inside the car

5. **V2X:** The data in the car can be from the car sensor or from cameras watching the road to help the car make sense of its surroundings to drive with ADS features or to drive autonomously. This data is transferred to the cloud such as the OEM's private cloud or smart city infrastructure and in that case it is called V2I or Vehicle to Infrastructure. One example of this is when four different car makers Ford, BMW, Mercedes-Benz and Volvo, partnered to share road safety data using a common cloud. Data can be shared between vehicles to communicate with each other directly and in that case it is called V2V or Vehicle to Vehicle.
6. **Digital Twins:** A Digital Twin is a digital replica of a physical asset that comes from the world of connected devices and IoT. This is essentially sensor data from any "thing" that is collected in the cloud and used to run simulations to manage the physical thing. Now it is used in cars with car parts being tracked remotely to check for health of parts. This is known as the digital twin in the car. There is a movement to build a digital twin of the inside of the car environment to manage the in-car experience and to make a third digital twin of the human themselves in the car to track their moods and behaviours. It is important to consider the ethical issues about passenger agency in the car with this.

Dr. Ashwin Sabapathy in the Telematics Wire article from April 2021, titled "Data Science Applications for Automotive Data '' shared driver behavior modelling, risk scoring and accident claim support with accelerometer data as potential data science applications using the sensor data from the vehicle. All these applications are possible only from the digital twins from the vehicle. These promises risk mitigation for insurance companies and potential fuel efficiency with route planning and driver training.

CapGemini Research shows that the top application that the Automotive industry is adopting with AI is Digital/ Mobility Services. Examples of such services are preventive maintenance for dealers using data from the connected vehicle or in-car advertisement to offer recommendation to passengers based on their behavioral analytics data.

7. **Federated AI:** Federated AI is the technology of building AI models at the edge as in the car, across multiple organizations to develop a combined shared learning model. The goal is to protect the privacy of the data involved and create a shared model across the industry or partners. Porsche had tested out Federated AI models in the automotive. This technology has the potential to speed car cognition and AI in the car for ethical human centered customer experience in the vehicle across industries.
8. **Edge AI in the Car or EdgeML:** Sometimes the data is used to create design experience for the person inside the vehicle using voice, virtual reality or augmented reality. One example of this is when Mercedes-Benz digitized their driver's manual using an Augmented Reality experience called 'Ask Mercedes.' The data can be stored in the vehicle to personalize the user's experience. In that case it is called edge intelligence. If Machine Learning models run on the edge, like at the ECU, then it is called EgdeML. In this case, the models learn from the device data and do transfer learning to share their AI learning without transferring data from the vehicle to the cloud to be improved from the learning from other vehicles. Today such edge AI is used in car cognition.
9. **Data Platform:** Edge intelligence can be combined with other data feeds such as weather feeds or location specific information or a retailer's information to offer advertisement or recommendations for users. These create new business opportunities

and have the potential to extend the disruption from the car from automotive to several other industries such as Retail, Insurance, Smart City and Healthcare. Complex data integrations and processing require a robust data platform inside the car. Several Car companies are deploying data platforms in the vehicle to support applications for shared mobility and logistics management using a fleet of vehicles.

10. **Blockchain:** Automakers are experimenting with Blockchain in the automotive to track supply chain and secure data. There is no standard with Porsche working with XAIN, Volkswagen with IOTA and Daimler AG with Hyperledger fragmenting the potential to benefit transportation and autonomous vehicles. The best use case is the secure OTA (over-the-update) which will benefit from Blockchain in the Autonomous Vehicle.

> **ARTIFICIAL INTELLIGENCE (AI) THAT POWERS THE AUTONOMOUS FEATURE IS A NARROW AI THAT REQUIRES TRAINING DATA FOR SPECIFIC ROAD CONDITIONS TO TRAIN FOR ALL POSSIBLE HUMANS, OTHER VEHICLES AND OTHER THINGS THAT WOULD CROSS THE PATH OF A VEHICLE**

Conclusion

The entire technology stack is in the process of moving to the car. Technology companies have begun competing to offer a mobility platform inside the car and some companies are building data platforms inside the car. AI powers car cognition to drive autonomous driving with many potential applications evolving today with connected vehicles with more potential applications evolving as the autonomous vehicle moves from Level 3 and 4 towards full autonomy. ADAS features and connected automotive capabilities are already offering data science and AI applications as the connected car generated more data with mobility options as the automotive meanders on its journey to become software-on-wheels.

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AI At The Edge

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Edge computing is steadily gaining ground in the automotive industry. To carry out complex functions at the 'localized' controller is becoming a core strategy for future tech builders. This, instead of sending all raw data to the cloud where all the corresponding analytics algorithms are deployed. As requirements transcend traditional telematics and analytics providers break new ground, widespread edge computing is inevitable. As these evolve so will the need for AI, to the point that Reactive AI may see a rapid move to Limited Memory AI.

This does not mean the edge should do all the functions. Rather, it be entrusted with the vital instantaneous processes and strategic 'heavy lifting'. Functions carried out in the cloud may be serving other purposes which don't need real time priority. Both edge-processed data and strategic raw data will be beamed to the cloud. So what kind of real time functions would new telematics ecosystems handle such that edge computing be so vital to them, you may ask. Prognostics or preventive maintenance at the edge has great potential to cap emissions. How this can be achieved needs a quick explanation of the difference between diagnostics and prognostics. The powertrain Engine Control Unit (ECU) irrespective of its motor windings or pistons has a tried and tested diagnostics software layer built for sensing and reporting all kinds of failures. What this layer does not possess is the ability to sense interim deterioration and quite often a partial failure. This deficiency can be made up with raw data analytics. The prognostics layer is a stand-alone layer which can be deployed in the OEM's Telematics Control Unit (TCU) or even an Aftermarket Control Area Network (CAN) enabled IOT device. The ability to analyze powertrain raw data when the vehicle is operating in the real world is profound. This can happen only at the edge. While this is technically feasible at the cloud as well, sending all this high frequency raw data to the cloud can prove inefficient predominantly because it may become an expensive proposition. Sensing system or sub-system level deterioration via powertrain raw data analytics at the edge can cap tail-pipe emissions for an Internal Combustion Engine (ICE) equipped vehicle. Similarly analytics at the edge for an Electric Vehicle (EV) can forewarn for anomalies in the electric powertrain or degradation of the battery.

AI at the edge is the key to building robust capability to detect underperformance. The application of this is immense. While sensor plausibility checks for the wide array of sensors onboard an autonomous car are no doubt part of its architecture, a holistic system deterioration sensing capability is an imminent addition. The Limited Memory AI entrusted with the safe operation of an autonomous vehicle is perhaps also best employed for this addition. As for the prognostics for the ICE a Reactive AI fused with a domain specific expert system is, perhaps, optimum. This is so because the Aftermarket has a great number of different types of vehicles rendering even the best of AIs, though bristling with learnt patterns and trends, a bit overwhelmed. This strategy can also be used by OEMs when focusing on a particular model being rolled out. It is difficult to say if for this application the hybrid AI will be a good fit or would Limited Memory AI be a better one. Perhaps the latter may be a bit of an overkill, especially when aiming for optimality, only time will tell. The expanse of powertrain engineering widens with every passing year. From internal combustion to battery powered electric to hydrogen electric powertrains, the innovation is inspirational. If we were to focus on just the ICE, the improvements being made are astonishing. The never-say-die attitude of the ICE community is admirable. How else would one explain the lust to challenge the very essence of the ICE – its thermodynamics, or ever evolving forced induction systems, or the artful amalgamation of the 'i' and the 'e' motors. From Camless engines to fundamental changes in the combustion chamber to the very construction of the century old reciprocating mechanism, the list goes on. Therefore, a watchful hybrid AI makes a good case for itself.

Edge computing can be an important contributor to the complex OEM ecosystem. AI at the edge for real world and real time prototype vehicle testing brings vehicle, tester & engineer closer together like never before. Complicated but versatile software libraries sitting in the edge can compute real time parameters related to engine driveability, performance and emission. The processed data essential for the engineer back at the R&D base is transmitted real time. Edge deployed algorithms watching powertrain health, driver/rider inputs, temperature-pressure gradients of the exhaust gas treatment (EGT) system will inform real time of tester attributes and system underperformance leaving very little raw data for the engineer to deal with. Striving for this seamless and flawless performance from a telematics system is achievable with AI at the edge. Vehicle quality assessment at the End-Of-Line (EOL) is another area for AI based edge computing. Also an Industry 4.0 application, this is an interesting potential starting point for edge computing at the beginning of the automotive value chain. Whether its vehicle testing at the EOL chassis dynamometer or track testing, both will use an AI powered small footprint computing unit. The unit with real time

visualization will guide the tester with instructions for perfectly choreographed data mining so as to feed the AI for a step by step assessment and result declaration at the edge. The results against each Vehicle Identification Number (VIN) are sent from the edge to the OEM's cloud for archiving. This digital detailed powertrain health record would bring unprecedented quality control and management ensuring every vehicle leaving the factory is as perfect as the other. A variant of this solution for the OEM dealership adapted for a typical urban test drive in lieu of the regimented EOL one for powertrain health assessment would truly connect the two ends of the spectrum. This ability to track the vehicle from its place of birth to its place of upkeep can be of great value to the OEM in more ways than one. It would provide incessant accurate data for superior vehicle design & engineering, reduced warranty claims, customer delight etc. With emission legislation mandated feedback and confirmation of performance proofs required by the authorities this capability can prove very utilitarian for all involved. There is also the ever attractive cost reduction factor which could make a strong point for OEMs looking to reduce expenditure on expensive vehicle mounted Portable Emissions Measurement Systems (PEMS). These, ofcourse, are the gold standard of real world emission measuring systems but may not be needed for all tests. AI powered CAN enabled IOT devices running complex algorithms to monitor and accurately predict EGT real world performance and premature failures are becoming a reality. Wayward Diesel Particulate Filters (DPFs), Lean NOx Traps (LNTs) and Selective Catalytic Reductions (SCRs) could be checked both at the EOL or monitored during prototype vehicle testing.

Introducing AI at the edge for real time decision making is the natural next step of distributed analytics. There is no doubt that AI at the edge is a game changer. To automotive professionals from various fields this opens up new frontiers. The future is optimum. ❑

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Network Awareness and its Untapped Potential for Connected Vehicles

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The importance of connectivity in cars and the ecosystem required to support connected vehicles is being realized by leading car manufacturers and communication service providers (CSPs) globally. Connectivity is becoming a core offering of the car rather than being just a feature. With 100 million connected cars expected globally by 2025, the core challenge faced will be around receiving and sending large volumes of data successfully to and from the cloud platforms. As per the conservative estimates, IHS automotive states that an average car will produce 30 terabytes of data each day. With more advanced applications being added to the cars that demands higher bandwidth, the data usage is only expected to go up significantly. Handling data flow at this scale with low latency and minimum packet loss will be instrumental in achieving business efficiency and superior customer experience promised by the connected vehicle technology. This can be achieved by bringing network awareness to the connected car cloud

Network awareness is defined as the ability to have higher visibility of the underlying network conditions. A network aware application has the ability to react to changing network conditions so that the end user experience is minimally impacted. In the context of connected cars, a network aware cloud would plan the communication with the car based on the availability and health of the underlying network resources. This would ensure higher success rate in completing this high data communication between the cloud and the connected car without any data loss and latency. In the coming sections, I am going to touch upon the untapped potential of network awareness in connected vehicles from the perspective of Over-The-Air (OTA) updates and Security

Over-The-Air (OTA) is a technology to remotely update the firmware and software in the car, which helps in upgrading functionalities and implementing bug fixes remotely in the embedded software installed on its Electronic Control Units (ECUs). This has helped in achieving lower cost for the OEMs attributed to decrease in vehicle recalls, improved passenger safety from immediate update of critical components and superior customer experience through reduced dealer visits. With increase in the number of features in connected vehicles, the number of lines of software code in the ECU is increasing exponentially that leads to a higher margin of software bugs. OTA software update is the most practical approach to handle these situations, where frequent OTA software updates to connected cars are going to be the new norm. As per IHS Markit, more than 350 million vehicles will offer OTA by 2025 and most TCUs/ECUs will offer OTA by 2024. The criticality of OTA firmware and software update can be realized from the fact that faulty

update on the ECU will make the vehicle undrivable. It is therefore important that the OTA firmware and software update campaign to a fleet of connected vehicles has a higher success rate. Including network awareness capability in OTA campaign management functionality of the connected car cloud would go a long way in achieving this objective:

1) Network Health Insights – Including network health as a parameter in planning a high data OTA campaign to a fleet of connected cars will go a long way in increasing the success rate of the OTA campaign. Such high data campaigns should be avoided towards cars in a congested network where the chances of OTA update failing are very high. Connected car cloud can modify its OTA update campaign to be executed only towards fleets that are in an area of lower network congestion
2) Optimized use of network resources – Equipped with network information like cell ID, connected car cloud can distribute the high data OTA updates to fleet of connected cars located in different cell IDs so that load on the network resources are evenly distributed leading to higher success rate of the OTA update campaign
3) Avoid Roaming Costs – Network awareness enables the connected car cloud to understand if a connected car is roaming on a different network. This will allow the connected car cloud to avoid noncritical OTA updates for roaming cars, thus saving roaming connectivity costs. The OTA update for such cars can be reinitiated when the connected car cloud detects the car to be back in its home network
4) Ease of troubleshooting – Network awareness will also bring efficiency in troubleshooting failed OTA updates due to network issues, which will lead to faster problem resolution and increased customer experience
5) Draw predictive analytics – Network aware information over a period of time will enable the connected car cloud to draw predictions on network health which can be used as an important criterion in the OTA update campaign planning for higher rate of campaign success
6) Network Subscription Insights – Access to network subscription information would make the connected car cloud to plan OTA update campaign based on the data subscription state and limits of the connected car fleet. This ensures that OTA update failures due to limited data bandwidth can be avoided and proactive actions can be taken to increase data bandwidth required for successful OTA update

As complexity increases, security considerations becomes more important. Connected car segment is no exception to that. With increase in the number of connected vehicles, there is also an increase in the number of security threats from malicious hackers. Hackers gaining access to connected car clouds is putting both physical security and data privacy of the users at risk. These events negatively impacts the brand reputation of the OEMs and also exposes them to serious legal infringements attributed to violation of user data privacy. Protecting the connected car cloud from malicious hackers therefore is becoming a high priority for OEMs. Network Awareness will enable the connected car cloud to have better control on the fleet of connected cars. This will ensure that the connected car cloud, user data and the wider connected car network are protected from cars that have been hacked:

1) Temporary Connectivity Suspension – In an event a car is hacked, network awareness can empower the connected car cloud to disable the connectivity of that particular car remotely. This will ensure that the hacked car is disconnected from the wider connected car network, so that the hacker doesn't get access to the wider connected car network. Once the security situation is addressed, the connected car cloud can resume the connectivity remotely
2) Protection from obsolete fleets – While it is easier to connect a car to the connected car cloud, disconnecting obsolete fleets in the field is always a challenge. Obsolete fleets pose a high security threat for the connected car cloud and are easy targets for malicious hackers. Network awareness would allow the connected car cloud to address these security challenges by terminating the connectivity of such devices remotely

While I have touched upon only 2 facets, access to network awareness will open the door to a lot of new business opportunities for the automotive OEMs in the connected car segment. Network awareness will fuel the engine of business and operational efficiency through a variety of use cases achieved through better location accuracy of the device fleets, greater control of eUICC (E-SIM) based fleets and flexibility in managing network subscription. However these use cases are just scratching the surface of the potential of network awareness. Network awareness will play a key role for the automotive OEMs to reduce cost, improve service performance and increase customer experience ❑

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Bringing Static Vehicle Build and Dynamic Driving Behaviour Data into Insurance

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Anyone fortunate to drive a new or relatively new car will appreciate how, over the past two decades, there has been significant investment by car manufacturers around the globe into making their vehicles safer, easier and more pleasurable to drive. Where once slowing down and bringing the vehicle to a stop relied purely on the actions of the driver, now, over 70% of new cars in the UK for example, have Automatic Emergency Braking (AEB) as standard and over 83% have a self-activating system .

As a consequence of this continued investment by car manufacturers, driver assistance technology, together with the driving data generated and recorded by cars through imbedded connectivity, has been on a massive growth trajectory.

All cars are expected to have advanced levels of connectivity by 2030 , generating, receiving and sharing a wide range of data into eco-systems including the car manufacturers to help them better serve their customers and support their goals of zero emissions and zero fatalities. Worldwide sales of connected cars with embedded telematics are already estimated to have hit 28.5 million units in 2019 and Europe is slated to be the market with the largest connected car parc globally in 2023 . Furthermore, in the 5-year period between 2015 and 2020, the global Advanced Driver Assistance Systems (ADAS) market doubled in size and is expected to reach nearly 32 billion U.S. dollars by 2023 .

Although one of the prime focus areas today for car manufacturers is reducing emissions by electrification, the OEMs also need to lower the cost of ownership for their customers and engender brand loyalty in this highly competitive market. Maximising the value of vehicle data to help drive ongoing developments in ADAS would be an added bonus if pursued in the future.

Building connections between car manufacturers and insurers

Vehicle insurance cover is an essential element within the cost of ownership. Car manufacturers have therefore been looking for ways to create connections with insurance providers to help their customers access competitive insurance premiums and cover that truly reflects the investment they have made in their car's in-built safety features - whether they come as standard or as selected additional options at the point of purchase. They also want to ensure their customers are given the choice to access more personalised insurance products and services, such as usage-based insurance (UBI) or pay as you drive (PAYD), based on driving behaviour data from their car's imbedded connectivity.

Historically, the use of telematics for insurance has been dominated by aftermarket devices or 'black-boxes'. With in-built capability, the connected car data has the potential to go more mainstream and assist with additional use cases.

The continuing advances in ADAS and the growth of connected vehicles provides a rich stream of static and real-time driving data that can offer a fair basis for pricing motor desired by consumers compared to current estimates used by the insurance sector for calculating risk. Traditional rating factors used in motor insurance underwriting can be complemented to hone further in on risk as more vehicle data starts to come into the insurance eco-system.

But first, the capability needs to be built to make vehicle centric data accessible and usable for insurance.

Bringing ADAS data into insurance rating

Starting with ADAS, insurance providers need to understand the impact of these valuable and effective systems on claims frequency and severity to help calculate pricing relative to the predictive loss cost. For car manufacturers, there is also huge value in understanding the link between in-car safety features and insurance claims for vehicle-level benchmarking and to understand ADAS system efficacy. This insight could also give car makers the ability to showcase to customers the true safety impact of purchasing vehicles equipped with these features as part of their marketing activity, which could also be very powerful when a customer is deciding whether to invest in the technology.

The problem for the insurance market is that deciphering the precise specification on a new vehicle is very complex with a variety of standard and optional features that will include ADAS. Also, ADAS features tend to be described very differently from one car manufacturer to another to differentiate themselves from their competitors. An additional consideration or complication is the availability of 'packs'. This is where the OEM will group together a number of safety features and offer this as an equipment pack with its own name. The content of the 'pack' may also differ over time based on consumer demand and competitor benchmarking.

To help solve this issue, an ADAS classification system has been created using machine learning to scan millions of lines of car manufacturer vehicle data to logically sequence and classify vehicle safety features and the component's intended operation or purpose.

European motor manufacturers are now starting to share ADAS data, and testing is well underway to build intelligence around how ADAS fitments relate to claims with motor insurance providers in the UK and Europe. At this stage, over two-and-a half million vehicles have been assessed across four European countries.

The LexisNexis ADAS Classification currently system consists of approximately 60 separate features. In depth analysis has identified certain features as being

"core" in terms of helping to reduce claims frequency. That said, all ADAS features will have the ability to assist the driver and often this can reduce overall driving effort and fatigue – thus contributing toward safer driving.

Access to vehicle safety data will help insurance providers factor for their presence throughout the customer journey and establish the differences in risk profile associated with the vehicles that have these safety features. It means that for the first time, confirmation of the safety features of a car, along with how well they perform will be accessible to insurance providers at a Vehicle Identification Number level for insurance quotes and renewals.

Connected cars – solving the 'many to many'

In addition to the 'static' vehicle build information, dynamic driving behaviour data from a connected car goes much further, and even holds the potential to confirm if an ADAS feature is enabled and if it has been activated.

Consumers see tremendous value in vehicle connectivity, with McKinsey's 2020 consumer survey on autonomous driving, connectivity, electrification, and shared mobility (ACES) revealing that 37 percent of respondents would switch car brands to achieve improvements in this area. The survey also found that 39 percent of consumers were interested in unlocking additional digital features after purchasing a vehicle—a figure that rises to 47 percent for customers of premium OEMs.

Driving behaviour data from connected cars can be fed into the insurance market, with the customer's consent, for use in insurance pricing so that consumers have the choice of accessing more accurate, appropriate and personalised insurance coverage (UBI), based on their own individual driving behaviour.

To make this work, you need to connect many car makers to many insurance providers for many vehicles and their drivers. One-to-one connections aren't efficient. At the same time, there will be data flowing from millions of vehicles which will need consumer permissions to share with the insurance market. The data will need to be standardised so that consumers are priced for insurance consistently regardless of the vehicle make or model they are driving.

Connected car data exchange

The formation of connected car data exchanges with participation from a growing number of car manufacturers in the US and Europe, is helping to solve this 'many to many' challenge. It enables driving behaviour data from motor manufacturers to be brought to insurance providers through one data exchange in a fully compliant, normalised, contextualised and standardised manner. The ultimate goal is to deliver this back as an actuarial grade driving score for UBI, regardless of the vehicle make, model or device type.

This approach removes much of the complexity, cost and compliance issues car manufacturers could otherwise face delivering insurance benefits from the connected car. We estimate that without a data exchange, building the connections it needs with the insurance market could cost car manufacturers upwards of $4bn . It also helps pave the way for subscription, pay per use, pay per mile and other mobility models of the future.

Creating consumer trust

Clearly customer trust and education must be at front and centre in defining when and how connected car data is shared with insurance providers. There are already multiple ways to obtain consumer consent to share and use connected car data - both OEM-led and insurance provider-led processes can be effective.

Looking more broadly, the European Union has initiated several funded projects designed to increase consumer confidence in the use of personal data generated by internet connected devices including connected car data. The smashHit consortium is one of these projects. This consortium has been tasked with creating a secure platform that will increase consumer trust and confidence in personal connected car data sharing for specific use cases. Utilising its experience supporting the insurance and car manufacturing markets in Europe and working closely with Volkswagen Group, LexisNexis Risk Solutions will focus on consumer consent for UBI insurance propositions, using insight derived from connected car data.

The growth of connected car data

Fundamentally, making vehicle centric data 'work' for the good of the customer, car maker and insurance provider will be reliant on a central data exchange connecting these two industries, where data can be normalised and managed in a fully compliant way. This will make the huge volume of connected car data meaningful and useable for insurance and other services.

During 2021, we will see the evolution in ADAS features that have over-the-air update capabilities, giving the consumer greater flexibility and control – sometimes referred to as "Feature-on-demand". Many OEM's including several from the Volkswagen Group are building vehicles with ADAS Capable features such as LED Matrix Headlamp units that the customer can upgrade to become 'adaptive'.

These kinds of over-the-air updates provide another reason why consumers are likely to want to have their vehicle 'connected'. It will give car manufacturers an opportunity to monetise the investment they have ploughed into connected car technology while allowing insurance providers to develop new propositions based on vehicle data or driving behaviour data.

A future in which an individual has the choice to be insured based on their car's ADAS data as well as how well and how far they drive is now within reach. ❑

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Andrew Ballard joined LexisNexis Risk Solutions in March 2019 as Senior Global Product Manager. He serves within the company's Global Product team helping to evaluate, test and build next-generation data services for the automotive industry and the insurance continuum, from the point of outreach to the point of claims, responding to the evolving client and market needs for more insight on the vehicle.

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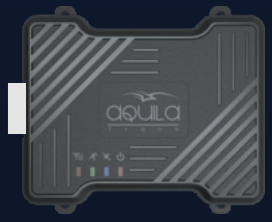

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Emerging Technology

SANTOSH KUMAR PANDEY
Skylabs Solution India Private Limited

Telematics for Electric Vehicles

With increased pollution and cost of operation the industry along with environment argument favoring electric vehicles to most of developing countries. The country is going crazy about battery operated vehicles. On average, electric vehicles are 75-80% cheaper from fuel and maintenance perspective, which is an important consideration for many consumers who look for value for money.

The Indian government is targeting for its goal of making 30% of Indian vehicles electric by 2030. There are many steps taken in 2019 to promote electric vehicles in the country which includes benefits on GST, Tax Exemption up to INR 150000 on electric vehicle loan and Many more.

While this growth is good news, it is not totally unexpected. Drastic improvements in EV technology, along with the government's focus on reducing global warming and encouraging zero-emission vehicles, have provided a much-needed impetus to the EV market.

Specific Telematics Role:

Emission reductions and the lower cost of ownership, which are the primary benefits of EVs, are tied to the utilization rate. If your drivers fail to properly charge plug-in hybrid electric vehicles (PHEVs) or drive in fuel mode, EVs will neither help in saving money on fuel costs nor make a considerable impact on reducing emissions. Field service managers also need to monitor State-of-Charge (SOC) of EVs, before putting them into use as well as make drivers

responsible for understanding when and where to charge.

We can get all this information by installing telematics devices with battery management system reading capability, which will track following basic data to help users avoid any failure:

1. Battery status of health (SOH)
2. Battery status of charge (SOC)
3. Monitoring battery consumption pattern
4. Improving driving habits
5. Location monitoring (GPS) and booking of next charging station

Since 1996, every car manufactured in the US since 1996 is required to be OBD-II (On board Diagnostic) compliant. When the vehicle's onboard computer detects a problem, it outputs a specific OBD code which is read by the scanner or reader. These OBD-II codes can help the mechanics diagnose emission, powertrain, and other issues.

The OBD (On boarding diagnostic) system was first introduced in India in the year 2010 (limited to light-duty vehicles) and as per the recent BS6 mandate; All vehicles manufactured post-April 2020 will have to be equipped with the OBD-II system.

According to Global Market Insight Inc. The OBD aftermarket is projected to cross $1.5 billion by 2024. With the significant growth in EV technology, the demand for OBD telematics systems for managing and controlling the car's complex network of components is likely to increase significantly. ❑

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Artificial Intelligence in Automotive - Fleet & Passenger Safety

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Artificial Intelligence is a commonly used buzzword in the technological industry, it has also been held as a game-changer in many industries. Some experts even go as far as to claim it will soon replace humans, very few really understand the true meaning of the term, and how it can be used to improve our day-to-day lives and our business. To simply put, AI is building up deep machine learning capabilities that mimic cognitive functions associated with the human mind, such as learning and problem-solving.

Since the beginning of the twentieth century, artificial intelligence has acted as the main anchor and driver of emerging technologies like big data, robotics, and IoT, and continues to play a technological innovator for the future. It also has a profound impact on the automotive industry.

Some of its advanced technology has benefited fleet management. Fleet operators, such as OEMs, telematics companies, car-sharing companies, and enterprises with large fleets, have the most to gain from advanced analysis of the data collected from the vehicles in their fleet. These companies use smart devices such as sensors and actuators to capture huge amounts of data to compute them and show results on a real-time basis. This data can include anything from location, speed, distance, fuel consumption, driving behaviors, and even doors left open, all of which can be used not only to improve management but also to eradicate vehicle misuse by drivers.

The major challenges standing in the way of fleet operators are to increase control and efficiency out of such large amounts of data generated, and the various formats in which they are provided. Operators lack the knowledge and time to scrutinize the terabytes of information passing through their legacy system each day. The solution is created by combining the collected information with novel machine learning techniques and advanced big data analytics, through which operators will receive a coherent view of their fleet, be able to monitor and manage them adeptly, easily detect issues, and enforce their fleet's policies.

Artificial Intelligence has also helped improve many other aspects of fleet management and maintenance, from reducing unplanned downtime to increasing efficiency throughout timely maintenance, repair processes, and improving fuel economy. Machine learning and AI can provide fleet operators with critical data that can be used to optimize operations, as well as predictive analytics to enable better decision-making in the future based on the analysis of past fleet activities.

Apparently, the use of artificial intelligence has not been restricted alone on tracking fleet performance alone but it has also expanded its reach on addressing more critical issues faced by fleet operators such as safety and security. When it comes to safety it usually encompasses challenges pertaining to the driver, vehicle, material or goods, and passenger safety.

While driving effective road safety solutions, artificial intelligence has the potential to make driving safer, by utilizing methods that can be used to learn from the various driving conditions on Indian roads, climate conditions and offering challenging opportunities in the scope of automated systems with an aim to aid drivers. Simple safety technologies have evolved, becoming smarter and producing more accurate, meaningful data for drivers and fleet managers. From collision warnings to vehicle tracking, AI is used to keep those inside and outside the vehicle safe. In-built collision avoidance technology has become a standard in most cars manufactured today.

Cars equipped with sensors and/or cameras assist drivers with a variety of safety solutions ranging from departure warnings to pedestrian and animal detection. Although the use of sensors and cameras isn't standardized in the commercial vehicle industry, the adoption rates continue to increase as the benefits of these investments prove effective. Fleet owners and managers see the value of adding driver assistance technology to increase awareness around the vehicle.

AI On Board

AI technologies can recognize obstacles, multiple objects, and hazards from a safe distance and send real-time alerts to the driver, all this happens within a fraction of a second. It also addresses the issue of safety through the advanced driver assistance system (ADAS). These advanced driver assistance systems also include high-definition cameras and onboard sensors that are currently used to capture the driving environment outside the vehicle as well as inside the vehicle; using framed images from cameras constantly to monitor the driver for drowsiness, and fatigue conditions.

This information is analyzed in real-time with Deep Learning algorithms and powerful integrated processors. Such a driver drowsiness detection solution has an artificial intelligence tool that detects whether the driver is falling asleep during his drive, and will be able to alert the driver to make a stop to rest. Technology has enabled it to detect incidents of concern or unsafe events to be analyzed and sent

to the fleet owners along with the relevant video and sensor information including intelligent detection of events such as traffic light violation, sign violations, relative speeding, and detections of hard acceleration, hard turns and hard braking.

Artificial intelligence is also helping enable customer experience through infotainment systems within cars. AIs in-cab alerts can get instant feedback on their driving behaviors, prompting immediate self-correction. Unsafe driving behaviors include things like using a handheld device, speeding, cornering, and not wearing a seat belt. Users are now able to connect their personal devices to their cars which helps them enable features such as understanding when fuel is about to end. AI uses this connection to communicate with the driver and alert them of the low fuel, as well as show available options for nearby fuel stations.

Driver incentive programs are one of the best ways to raise overall fleet safety and performance that motivates drivers to push themselves to be better, improve ranking, and be more aware of what they are doing every day in their vehicles. New technologies powered by artificial intelligence (AI), help fleets understand and coach drivers in real-time while maintaining driver privacy. With this new breed of intelligent driver safety systems, fleets can become safer and smarter by using a data-driven approach.

AI in Vehicle Maintenance

AI has also been adopted in the automotive service industry to different degrees. Some of the major applications of AI being used by companies are through Predictive Maintenance. Predictive maintenance lets you monitor the vehicle's health to avoid future failures during operation. It uses predictive algorithms with data from vehicle sensors to estimate when your vehicle will fail.

Vehicle manufacturers have hundreds of sensors, cameras, and instruments to monitor every aspect of the vehicle and provide feedback to the vehicle computer. The vehicle computer processes this information and uses it to intelligently predict the problem that may arise. These help vehicle owners and their mechanics replace parts and address various issues fast before they add up into much bigger problems.

Transport companies with large fleets of vehicles leverage the presence of these sensors by using advanced technology that links their vehicle ICUs to the internet to conduct a remote diagnosis. AI makes this possible thus helping the company avoid vehicle breakdowns when their fleets are on the road. This saves the companies both money and time as they are able to predict problems and solve them on time even if their vehicles are far off on the roads. While wear and tear will always occur, accidents can be prevented. The is why many vehicle manufacturers are currently developing several AI and machine learning-based technologies to help prevent accidents.

AI for Public Safety

Covid-19 has also undoubtedly transformed the way people work, travel around with serious implications that can be seen within the public and private transportation sector as well. The pandemic has changed the way in which people are commuting now. With people's safety in mind, the public and private transport operators need to revamp their operational procedures to prioritize commuter safety and gaining their trust. Safety measures such as sanitization, proper implementation of social distancing are a must now.

Applications of Artificial Intelligence, the Internet of Things, and Intelligent Transportation System can tackle many such problems of the transportation system. It can also help to reduce human-to-human transmission and prevent cluster outbreaks in public and private transportation systems by monitoring adherence to COVID-specific norms and SOPs while improving efficiency and ease of monitoring.

Some solutions like camera-based AI modules can monitor transport infrastructure to detect adherence to wearing Masks and Social Distancing norms. These AI systems powered by sophisticated neural networks can also detect instances of crowd formation and generate alerts. Innovative solutions like thermal temperature screening, face mask detection of passengers before boarding a ride would also ensure utmost safety procedures followed.

Combining thermal imaging with video analytics and AI techniques provides a robust system to identify individuals, their body temperature, and whether they are wearing masks. To enhance fever detection, facial and skin temperature data are sent to AI models which track temperature information and any anomaly with historical data is flagged. This system could be integrated within public and private transportation systems for contact tracing, to accelerate tracking speed, locate exposed individuals and quickly contain the spread of infection.

With advances in high-performance computing and big data, companies will be able to utilize simulations in real-time to solve crowding problems. It is not just for crowding incidents but this system can be utilized for improving response times during all types of incidents, tracking failures, signaling systems issues. Investments in such systems not only address the current needs for infection containment or incident management but will also create new services, experiences and add value.

Using machine learning and big data analytics will help generate meaningful insights, and can automatically highlight important safety features, safety alerts, and risky driving behaviors instead of laboriously going over endless columns of information to generate meaningful insights.

AI is not the only technological solution for all problems, but when accompanied by fewer changes in infrastructure and process changes, it can be transformational for many industries, including transportation. ❑

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Also the CEO of Transworld Technologies Ltd., a Wireless Internet of Things company, Vikram designs and builds edge computing systems and Cloud Big Data. Their embedded wireless device, the Mobile Eye, won the GS Parkhe award for innovation. He is also the recipient of the Bootstrap Hero award from TIE.

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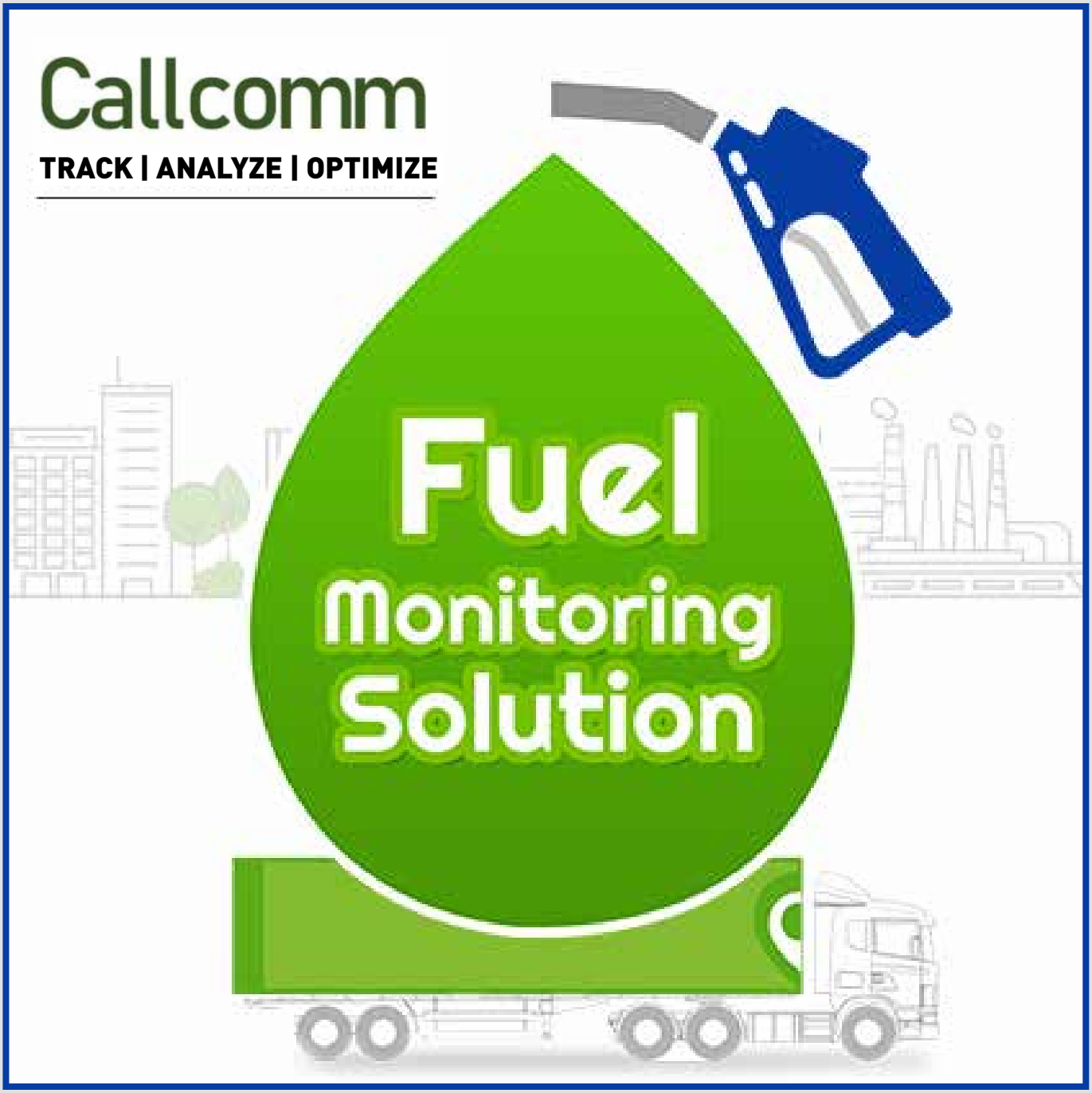

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Emerging Technologies in Automotive Sector

RICHA TYAGI
TELEMATICS WIRE

The automotive industry which is over hundred years old has ever since been working hands-on with emerging technologies for delivering safest, advanced and most comfortable vehicles to its users.

Today, the industry is adopting new technologies such as the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML) and more, and is exploring their applications in the automotive sector. With the accelerated digitization of the world, the automotive industry will evolve faster in the coming years. Mentioned below are some ways technology is changing the automotive industry:

Nissan Virtual Showroom

Digital marketing and sales

The COVID-19 outbreak made us give up many habits but also gave rise to new trends. Automotive companies have moved towards providing a digital platform, which makes way for an immersive and seamless digital experience using virtual and augmented reality.

Online sales of automotive vehicles have already been implemented by large automobile institutes to provide their customers with a superior experience of buying and selling cars. But it came to effect during the coronavirus pandemic. It will definitely minimize physical interactions. It includes the usage of VR (Virtual Reality), IoT (Internet of Things) and AR (Augmented Reality) to implement the latest technologies including the use of multi-hybrid cloud network architectures.

In May 2020, Nissan introduced its digital sales initiatives in India to promote customer engagement through online platforms and minimize physical interactions. 'Nissan Virtual Showroom' allows customers to take a 360-degree tour of the brand's vehicles and explore their features. Users can take a walk around of the exteriors also have a look inside the vehicles' cabins.

Mahindra & Mahindra Ltd. also launched its 'Bring the Showroom Home', a portable, mobile based, interactive Virtual Reality experience. In this the customer will get a 360 degree, all-encompassing and immersive virtual showroom experience. It was part of a series of initiatives under Mahindra's Digital Transformation Strategy.

Many automobile companies provide a digital experience of their products with the use of AR or VR. For example, Honda Cars launched their virtual showroom which allows customers to

Yamaha Motor Virtual Showroom

The biometric authentication system is highly secure and convenient as it uses individual biometric information; Source: Hyundai Motor Group

interact with the digital version of a car by clicking on various parts. MG Motor India opened its Digital Studio with no car on display in Bengaluru. Amid the outbreak of Coronavirus, India Yamaha Motor has launched an online sales platform in India to drive more sales. Recently, Hero MotoCorp has started a virtual showroom for its scooters and bikes in India.

Biometric Seat Technology

Biometric technology began with a fingerprint recognition system to unlock smartphones, rapidly evolving into facial and iris recognition over the years.

Now Biometric technology is gaining attention as a next-generation technology that not only improves security but also improves the quality of life for convenience and health care. This is the reason that automotive industry is actively introducing biometric technologies in the form of biometric seats.

Biometric Seat works through a series of highly reactive sensors which are able to monitor the driver's breathing rate, heart rate and body temperature. By using this information, the car can send out warnings if it calculates that the driver is too stressed or tense to be behind the wheel. These sensors are located in the steering wheel and seat belts, which triggers automatic speed limit, audio warning, and ability to dial the emergency services.

Rise in adoption of artificial intelligence technology and integration of infotainment systems in vehicles are likely to propel the automotive biometric seat technology market across the globe. Major vehicle manufacturers and technology providers are investing to develop biometrics for several different use cases, from personalization to driver monitoring to vehicle access. Jaguar Land Rover is working to develop a facial recognition system to adjust vehicle settings with facial expressions. Hyundai Mobis has announced the development of a Driver State Warning (DSW) system with biometric facial recognition and eye tracking to prevent traffic accidents caused by careless driving. in 2011. Mitsubishi Electric Corporation introduced an EMIRAI car at the Tokyo Motor Show. Infrared technology enables biometric seats to measure the heart rate of the driver through the sensors equipped in the seats.

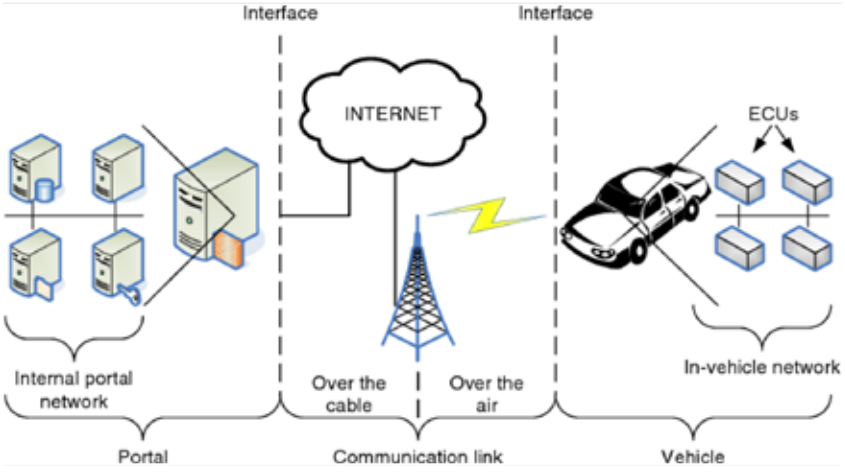
Firmware Over the Air (FOTA) Update

FOTA, or firmware over-the-air, is a technology that enables firmware downloads and updates for specific electronic control units (ECUs) inside a car. As the number of ECUs in vehicles increases, the sharing of diagnostic and operational data from on-board systems and components reduces costs of recall car manufacturers, increases product quality and operational efficiency, as well as deliver post-sale vehicle performance and feature enhancements.

For example, it can upgrade vehicles' steering systems, make driving operation easier, upgrade the response of the accelerator pedal, make acceleration more linear and comfortable, and more. Before the Tesla Model 3 went on the market, there was a problem with its braking. The braking distance of 100 km / h was 46 m. Following the subsequent OTA upgrade, the braking distance was shortened to 6 meters, greatly improving safety while driving.

Predictive Maintenance

Vehicle breakdown is one of the major causes of road accidents. These breakdowns occur due to human negligence in the timely service and maintenance of vehicles. Predictive maintenance is essentially a technique of collecting data through tools to predict possible defects in an automotive device



Secure Firmware Updates over the Air in Intelligent Vehicles; Source: Semantic Scholar

before it fails. Predictive maintenance is fueled by artificial intelligence and machine learning.

Manufacturers are implementing AI and ML algorithms to automate the vehicle's installation process, including its infotainment system and its application preferences. This makes vehicles new IoT devices that connect to smartphones or wearable devices. Machine learning models are trained with real-time and historical data associated with the device's operation. This training enables the underlying algorithm to estimate an anomaly that may occur in the future accurately. Equipment maintenance activities can be scheduled to prevent its failure.

The most important examples of predictive maintenance in the auto industry can be found in vehicle manufacturing and car maintenance. The use of AI in vehicle manufacturing facilitates the reduction of manufacturing costs.

Machine learning also empowers a vehicle to provide timely maintenance recommendations to owners. For example, vehicle sensors collect data on various phenomena such as friction, noise or gradual overheating of parts. These are the kinds of issues that can slowly break a vehicle's part completely. Machine learning algorithms efficiently record these events and analyze the frequency of their occurrence. Subsequently, it predicts that part of the vehicle should be upgraded / serviced to avoid a complete breakdown in the future.

Vehicles as IoT Devices

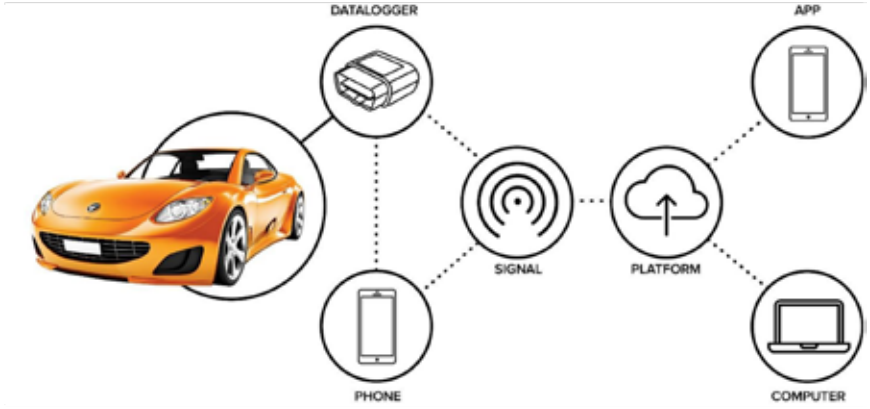
Vehicles have been connected for years, in ways that seem routine until now. They seamlessly link to smartphones, register real-time traffic alerts, stream Spotify playlists, and offer emergency roadside assistance at the touch of a button. Indeed, in the early days of the Internet, automakers started connecting vehicles with information streams. When it comes to connecting drivers and technology, the auto industry has a longer and richer track record than any other sector.

The IoT provides a great potential for interconnectivity, linking smart vehicles into a network. IoT technologies are used to create innovative and advanced solutions in the automotive sector, including connected car solutions, Advanced Driver-Assistance Systems (ADAS), in-vehicle infotainment systems, navigation & telematics solutions, predictive maintenance solutions, Vehicle-to-Vehicle (V2V) applications, Vehicle to Infrastructure (V2I) applications, and Vehicle to Everything (V2X) communication applications.

IoT use cases in Automotive Sector:

- **Fleet Management:** The implementation of IoT in automotive sector has brought a huge development in the field of fleet management. Nowadays trucks are integrated with weight measurement, location tracking, and many other sensors.
- **Connected Cars:** The idea of connected cars is not new. Connected cars enable fast transmission of data and increase the response time of drivers through enhanced vehicle communication. Based on the vehicle's connection with various objects, the CV2X is sub-divided into four categories: Vehicle to vehicle (V2V), Vehicle to infrastructure (V2I), Vehicle to pedestrians (V2P) and Vehicle to network (V2N).
- **Automotive Maintenance System:** IoT automotive maintenance system helps a person to take necessary steps to prevent its car parts from sudden breakdown. Like a vehicle's dashboard indicators, this system alerts the driver to potential malfunctions.
- **Autonomous Vehicles:** IoT-transmitted semi-autonomous cars make on-spot decisions while controlling vehicle operation to avoid an accident and reduce the load from the driver. With the accessibility of different sensors and cameras, the cars are integrated with the IoT system to reduce human error and make driving more comfortable and safe.
- **In-vehicle Infotainment and Telematics:** In-car Wi-Fi capabilities have enabled telematics facilities to be IoT-based automotive. Telematics refers to the long transmission of computerized data. Using vehicle telematics, a car owner can keep an eagle eye on their vehicle, even from remote locations.
- **Road Condition Analytics and Navigation:** Road condition analysis and navigation assistance is one of the most exciting use cases of IoT in the automotive domain. Smartphone applications, powered by AI, can detect the status of roads in real-time. It enables the driver to be updated on accidents, road closures, speed limits, construction work, and more. Smartphone apps are also integrated with a navigation feature. It helps guide the driver to their destination while providing the most optimal path based on real-time road conditions and traffic.

Internet of Things along with other attention-seeking technologies is transforming the complete automotive industry. The number of IoT applications in the automotive sector is increasing day by day. With the rise in the technology of the Internet of Things,



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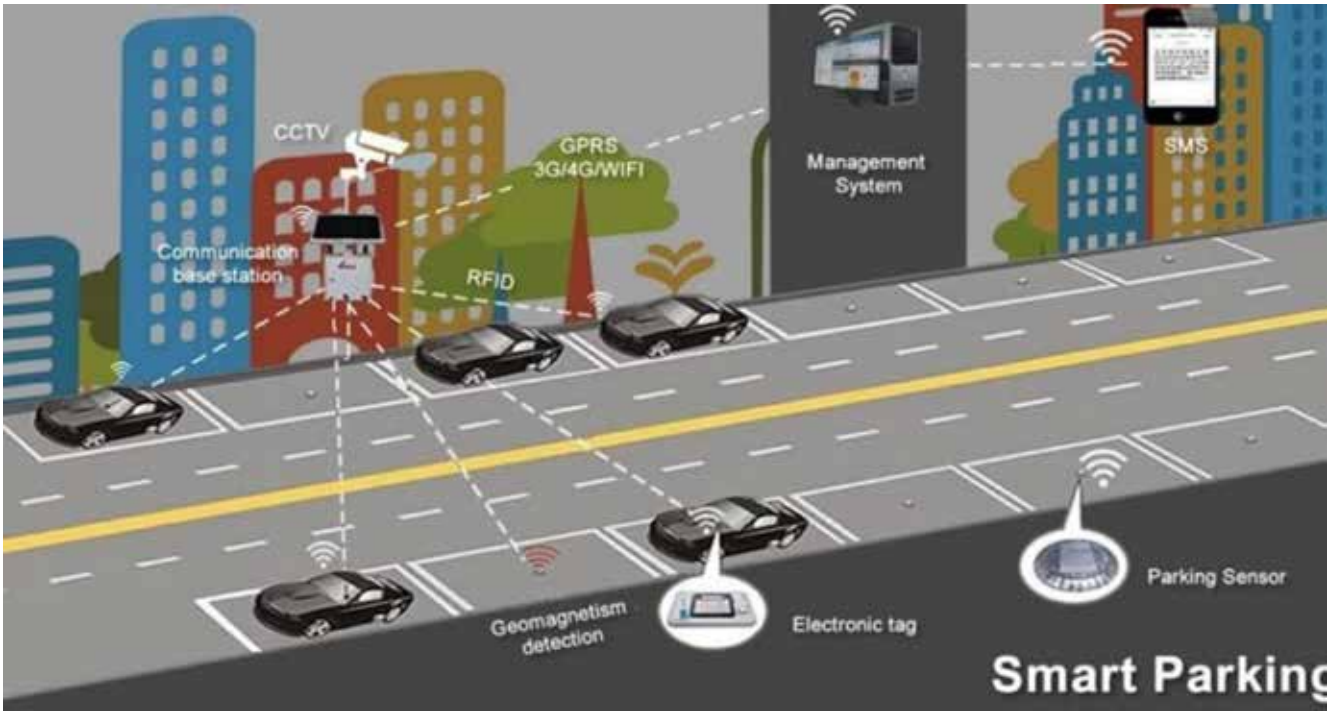

more sophisticated automotive use cases will pop up that will completely change the way we interact with our vehicles.

Advanced Motor Control

Modern vehicles are loaded with dedicated motor-control systems that drive all types of fans, pumps, compressors, and servomechanisms. Increased desire for maximum efficiency and control has led engineers to move beyond traditional scalar control systems to more sophisticated digital vector control algorithms capable of delivering full torque with acceleration and deceleration at precisely manageable rates.

Many cost-effective solutions have been developed, which still provide maximum control capability and enable engineers to harness the power of advanced vector control methods. NXP Semiconductors, Infineon, Embitel, Servotronix, Schneider Electric are some of the global solution providers. However, advanced motor control is a technical trend that provides a better driver experience.

Smart Parking

The smart parking industry is continuously evolving as an increasing number of cities struggle with traffic congestion and insufficient parking availability.

While the implementation of sensor technologies to develop smart parking continues, a wide variety of other technological innovations are also enabling adaptable systems, including cameras, wireless communications, data analytics, induction loops, smart parking meters, and advanced algorithms.

The IoT system of communicative devices enables drivers looking for parking spaces to see, in real time, if and where there are vacant spaces. Developing from a system in which drivers can arrive at multi-story parking lots and see red or green lights above the spaces, recent IoT technology has even more potential.

Automation technology in cars and parking lots is also significantly effective. In Boulder, Colorado, for example, parking provider ParkPlus have installed a fully-automated parking system in a fixed development. The technology installed here uses robotics to park vehicles. Upon entry, a vehicle is scanned with lasers, and as a moving platform a robotic valet lifts the vehicle and transports it to a parking space.

Leading smart cities identify that smart parking can be leveraged to park cars in the future. The AV fleet is expected to make a general change in the way cars are used, affecting how often and where future vehicles will be parked.

Conclusion:

There you have it, some of the advantageous technologies into cars today. The convergence of customer demands, and connectivity is revolutionising the automobile industry to bring more technological changes in the next decade. Vehicles have also started providing Internet connection to passengers. Innovation and creativity are the biggest priority of automobile brands to improve customer satisfaction and sales. With the world being digital, automobiles are also using the opportunity to integrate smart technologies into vehicles that serve to increase your ease of use.

Source:

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https://www.pathpartnertech.com/understanding-automotive-ota-over-the-air-update/

https://www.fpt-software.com/5-technology-trends-driving-automotive-industry-forward/ ❑

GM launches Maps+, an in-vehicle app-based navigation system

General Motors announced the launch of Maps+, an in-vehicle, app-based navigation system, upgrading capabilities for select model year 2018 and newer Chevrolet, Buick, GMC, and Cadillac vehicles by the end of 2021. Maps+, powered by Mapbox, is expected to begin its rollout to approximately 900,000 vehicles on April 30, as part of select Connected Services plans. Maps+ features include:

Cross-App Integration: (1) Voice command activation for new destinations and directions with Alexa Built-In (2) One simple interface for vehicle navigation and music and podcast selection

Personalization (1) Management of favorite locations and points of interest (2) Predictive keyboard entry when searching for locations (3) Modern map designs with day and night modes (4) Shortcuts for search categories, such as coffee, food, fuel, parking, recent spots, and favourites

Contextually Relevant Services (1) Routing based on real-time traffic and daily updating map data (2) Speed limit and road hazard alerts (3) Routing to nearby stations if vehicle is low on fuel (4) Notifications and alerts about faster routes.

ArriverTM to start deploying software on Qualcomm Snapdragon Ride Platform

Arriver has started to optimize and deploy its software for vision perception and drive policy on the Qualcomm® Snapdragon Ride™ Platform. The Drive Policy software is being ported by Arriver to the Snapdragon Ride Platform with Lane Support System, Forward Collision Warning, and Autonomous Emergency Braking as initial functionalities.

Arriver™ is using the AI and deep learning techniques to deploy its 5th generation 8MP Vision Perception on the Snapdragon Ride Platform.

Deep learning utilizes the new Convolutional Neural Network (CNN), a machine learning method for predicting output given some input, enables vehicle recognition up to 400 meters and pedestrian recognition up to 150 meters. CNN is approximately more than 50 times larger compared to the existing generation, and enables improvement in true positive (TP) rate, as well as significantly lowers false positive (FP) results with a factor ~x10-x50, given a fixed TP rate, allowing for the higher accuracy necessary for when the car takes over responsibility for the driver, as in Level 3 applications and beyond.

The Arriver™ 5th generation 8MP Vision Perception software will be scalable, flexible, and expected to be available to auto manufacturers and Tier-1 suppliers as part of Qualcomm Technologies' future product offerings.

Konexial announces GoFind™ advanced trailer tracking service

Konexial announced GoFind™ service addition to the My20 Fleet Management ecosystem. GoFind™ provides Konexial My20 Fleet users with access to advanced solar-powered GPS trailer tracking and sensing IoT devices to monitor and protect their assets and freight cargoes. This trailer tracking service includes connectivity and a customizable application with dynamic dashboards, analytics, and reports, all accessed inside ONE user interface, the Konexial My20 Fleet dashboard.

Konexial's My20 Fleet uses telematics technology to automatically log a driver's location, hours of service, and available capacity, and the Edge Computing architecture makes sure the system never goes out of service maintaining constant connection to the driver. My20 Fleet analyzes all data, algorithms and logic within the cab on iOS and Android platforms.

The Konexial GoFind™ tracking service can be installed in about 10 minutes on any trailer. The solar-powered device holds its charge for at least 6 months, allowing for storage before installment.

Microlise launches Trailer Brake Performance Monitoring

Microlise has launched Trailer Brake Performance Monitoring capabilities. Microlise Trailer Brake Performance Monitoring will help fleet operators reduce Vehicle Off Road (VOR) time and improve ROI by reducing the cost of quarterly brake testing.

The solution connects directly to a trailer's electronic braking system (EBS) and relays valuable information on status and performance. A simple scale of red, amber, or green is displayed in the Microlise portal, providing operators with visibility of brake performance across the trailer fleet.

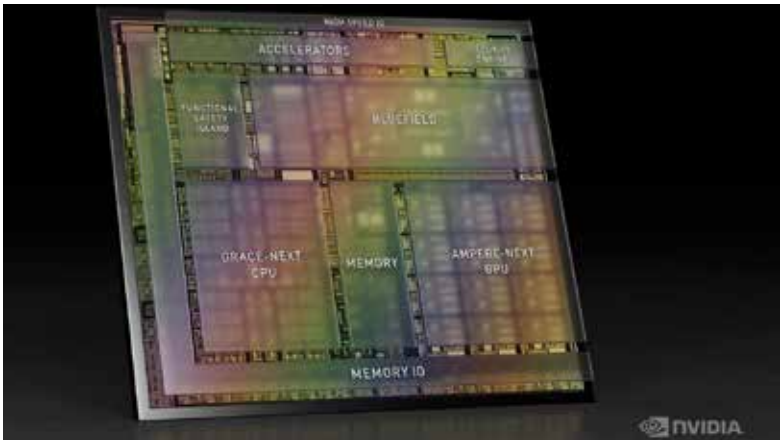
The product meets Driver and Vehicle Standards Agency (DVSA) industry-standard specification. In addition, the solution is also offering capabilities such as temperature monitoring, along with load-facing cameras to enhance load safety and security.

Loadsmart's true mode optimization to reimagine sustainable shipping

Loadsmart launched a new mode optimization capability that gives multiple instantly bookable rates for a single full truckload (FTL) shipment. Backed by data and analytics, the update provides the required information for shippers to select the most cost-effective and environmentally sustainable modes for FTL shipments. Loadsmart's feature identify which shipments are best suited for rail and which rail routes are flexible enough to permit shipments to reach the ultimate destination.

Loadmart's algorithms recognized 30% of all FTL shipments qualified as suitable for rail. Rather than having to seek multiple quotes for FTL and rail options, Loadsmart saves time by providing the data and intelligence necessary to instantly compare options and make the best decision with no additional rate discovery. This has the potential to reduce both costs and carbon emissions as one intermodal train is capable of hauling approximately 280 truckloads of freight.

Nvidia unveils Drive Atlan, a system-on-chip platform for autonomous vehicles



Nvidia has announced Drive Atlan, an AI-enabled system-on-chip platform for autonomous vehicles. Drive Atlan combines CPU, GPU, and DPU on a chip that utilizes deep learning, machine vision accelerators, and 'Ampere-Next' GPU resources to deliver 1,000 TOPS (Trillion Operations Per Second). The new Drive platform has a 4X lift over the existing Drive platform, Grace GPU complex, and Arm core technology.

Nvidia's Atlan with its BlueField data processing unit that is one place for storage, networking, and security functions is up to 33 times more powerful than its other autonomous car chips like Drive Orin and Drive Xavier. While Xavier gives 30 TOPs, Orin tops out at 254 TOPs. The BlueField DPU will offer intrusion detection, a "zero-trust" security architecture against cyber-attacks for the safety and security of self-driving vehicles.

ADAS & AUTONOMOUS VEHICLES

1. Verizon & Honda test how 5G enhances safety for connected and autonomous vehicles
2. Volvo Cars, Zoox, SAIC and more join growing range of autonomous vehicle makers using new NVIDIA DRIVE solutions
3. AVL and Foretellix partner to make virtual ADAS/ADS validation
4. Arbe's 4D imaging radar solution is now available on NVIDIA DRIVE platform
5. Unity signs MOU with Mando to develop front camera simulation technology for ADAS
6. WeRide allowed to test driverless cars in California
7. Baidu Apollo demonstrating a new commercialization model for autonomous driving
8. New Lidar technology improves Argo Self-Driving System
9. OmniVision automotive image sensors compatible with NVIDIA DRIVE platform
10. Walmart investing in GM's Cruise

Klas unveils TRX D8, a new data-logging hardware

Klas announced data-logging hardware for autonomous vehicle research & development: the TRX D8. It is an in-vehicle storage and compute system, a ruggedized device designed specifically for logging the massive amounts of data accumulated in autonomous vehicle drive testing.

TRX D8 is already in market with automotive OEM and boasts a rugged and compact design proven to perform in extreme environments. The TRX D8 collects data from onboard Ethernet and Controller Area Networks (CAN) and can hold up to 240 TB of storage in one easy-to-remove cassette. The D8 is also platform agnostic, easily integrated into R&D test platforms from multiple vendors or combinations of vendors serving the developing AV market

VEHICLE TELEMATICS

1. ALD Automotive partners with Telefónica Tech and Geotab to develop its connected car solution
2. AA Prestige and Herd Hire partner to deliver fleet maintenance platform
3. Mojio and Pouch partner to provide small businesses with free fleet management software
4. Utilimarc announced the signing of new customer, Avista to its Business Intelligence Platform for Fleets
5. SWR and Xperi partner to advance the radio listening experience
6. RAN Wireless adds fleet tracking to its offerings
7. Mercedes-Benz trucks pay automatically for fueling at Shell stations
8. ABI Research: Connected vehicle sales on path to recovery
9. Israel: Tactile Mobility with Union Motors launches data gathering project
10. Automotive OEM telematics in Southeast Asia market to reach $5.55 billion by 2025

MiX Telematics launches video telematics for driver behavior monitoring

MiX Telematics has launched MiX Vision AI – an extensive update to their video telematics offering. With this new solution, MiX Telematics further enhances its ability to help customers around the world improve driver safety and reduce operating costs.

MiX Vision AI leverages machine vision technology to detect and alert drivers and managers to unsafe or risky driving behavior that impacts road safety. Driver monitoring events include fatigue, phone use, distraction, smoking and seat-belt use, while passive ADAS events include forward collision and lane departure warnings. In-cab, audible alerts warn drivers in real-time so that immediate corrective action can be taken, while video footage is made available to managers via MiX's extensive online software and mobile apps for driver coaching.

Cruise to test its driverless robotaxis to Dubai in 2023

Cruise will launch its first international robotaxi service in Dubai. The company will start testing its vehicles in 2023, with plans to launch a commercial ride-hailing service soon after, though it hasn't specified an actual date.

Cruise will use its fully autonomous Origin vehicles, which it first unveiled in 2019. The company does not plan on utilizing its Chevy Bolt electric vehicles that it currently uses as part of its test fleet in San Francisco. Cruise said the goal is to scale up to at least 4,000 vehicles in Dubai by the year 2030.

Dubai may be a natural fit for Cruise's fully autonomous vehicles. The kingdom has the goal of 20 percent of its trips taking place in autonomous vehicles by 2030.

Velodyne and Ansys partner to develop software models for AVs

Velodyne and Ansys are developing software models of automotive lidar sensors to provide substantially improved hazard identification capabilities for autonomous vehicles. The collaboration incorporates Velodyne's lidar design into Ansys' virtual sensor suite and expedites automakers' integration of Velodyne's sensor into AVs, delivering driving safety and a drastically faster path to market.

Velodyne is collaborating with Ansys to integrate an encrypted 'black box' physics-based lidar sensor model into Ansys® VRXPERIENCE™, a real-time interactive driving simulator that models, evaluates, and validates lidar designs within a highly realistic virtual environment. As OEMs integrate Velodyne's lidar into their ADAS portfolio, VRXPERIENCE will reduce development costs by enhancing lidar placement within AVs and validating AV performance.

Mobileye to supply self driving system to Udelv

Intel said it is supplying self-driving systems to Silicon Valley startup Udelv, which plans to have a fleet of autonomous delivery vehicles in action within two years. Udelv and the Mobileye unit at Intel aim to produce more than 35,000 driverless "Transporters" by the year 2028. Operations will begin commercially by 2023.

Udelv automated delivery vehicles combine self-driving technology with robotics to assist with unloading cargo. The company said it has made thousands of automated deliveries in the US, carrying payloads of more than 800 pounds (363 kilograms).

BMW to use NVIDIA's Omniverse for virtual factory planning

BMW will be using Nvidia's Omniverse platform to plan complex manufacturing system. The virtual factory planning tool integrates various planning data and applications and enables real-time collaboration with complete data continuity.

The Omniverse platform, a virtual factory planning tool, integrates planning data and applications via a data layer in the cloud, enabling real-time collaboration without compatibility limits. Omniverse brings together data from multiple professional design and planning tools from different manufacturers to generate photorealistic real-time simulations in a single collaborative environment.

Pony.ai launches its new autonomous driving platform with Luminar

Pony.ai introduced its newly designed sensing platform in collaboration with Luminar Technologies, Inc.

Pony.ai is set to deploy automotive-grade production autonomous fleets in 2023 globally. The next-generation fleet will seamlessly integrate Luminar's Iris and feature a multi-sensor 360-degree configuration and a slimmest profile roofline at just 10cm off of the vehicle roof. The goal of the partnership is to increase safe, autonomous driving in complex urban environments with an integrated sensor design that leads advanced development to production scale.

Motional to use Derq's platform for 360-degree view of environment

Motional announced a partnership with Derq Inc to have access to 360-degree bird's eye view of the environment. The technology can help Motional autonomous vehicles navigate more safely in and around intersections.

Derq's technology uses cameras that are installed above busy intersections to collect data. The cameras are connected to Derq's AI-powered perception systems and roadside units (RSUs), which then transmits the data to Motional's autonomous vehicles in real-time. Derq's platform uses proprietary and patented computer vision and machine learning techniques to fuse data from IoT devices, such as traffic cameras. The cameras can help an autonomous driving perception system better identify a bicyclist weaving through traffic, pedestrians crossing the street between parked cars, or a vehicle exiting a nearby parking lot. All of these behaviors are typically encountered near busy intersections. The RSUs run Derq's AI-powered perception algorithms, which are used to predict the movements of other road users, which adds an additional layer of safety to an autonomous vehicle's perceptions systems. Derq uses real-time edge analytics to gather traffic insights. If the system detects that a pedestrian might cross the road from between two parked cars, a warning can be sent to the vehicle so the driver or autonomous vehicle's perception system is aware that they are present, even before they are visible to the vehicle's sensors.

Continental Automotive Edge to be hosted on AWS

Continental is collaborating with Amazon Web Services to host its cloud-based automotive software. Dubbed Continental Automotive Edge (CAEdge), the new platform connects ground vehicles to the cloud. The tool also features a virtual workbench that offers many options for developing, delivering, and maintaining software-intensive system functions. Furthermore, the workbench allows drivers to download convenient and easy software updates for the functions they want.

A key component of the project includes importing camera and radar data from a vehicle fleet into the CAEdge platform, which will then be used for highly automated driving simulations. Additionally, to processing vast amounts of vehicular data, CAEdge supports all steps in developing highly automated and autonomous driving systems, including sensor data collection, model training, and virtual simulations.

Essentially, the computing power provided by AWS and machine learning makes it possible for individual development steps that used to take several weeks now take a few hours.

Veoneer and Swiss Re enter partnership to further enhance development of ADAS technology

Veoneer, Inc. and Swiss Re are pooling their knowledge and experience on road safety technologies to further enhance the evaluation and development of advanced driver-assistance technologies (ADAS) and related services.

Through this partnership, Veoneer will enhance its ADAS technology using Swiss Re's knowledge of the real-world performance of ADAS systems based on insurance-relevant insights and a comprehensive approach to risk modeling. At the same time, Swiss Re will benefit from Veoneer 's ADAS hardware and software technologies. This information will feed into the Swiss Re ADAS Risk Score to the benefit of car manufacturers. Consequently, insurers will gain from being able to assess the latest car safety technologies for insurance purposes.

Veoneer radar and stereovision in Mercedes EQS hands-off self-driving tech

Mercedes EQS Drive Pilot system contains Veoneer's 4th generation stereo vision camera system, comprised of fully integrated hardware and perception software to master the challenges of highly automated driving. The system also contains Veoneer's advanced 77GHz radars using super-pulse modulation techniques for enhanced perception, operating at a distance up to 150-meters with high range resolution and supreme angular accuracy.

Veoneer's 4th generation stereo vision camera system uses Convolutional Neural Network technology for free space and small obstacle detection to maneuver safely. The stereo vision camera processes and classifies 3D objects (vehicles, motorbikes, pedestrians, lanes, landmarks, signals, posts, etc.) under a variety of weather conditions.

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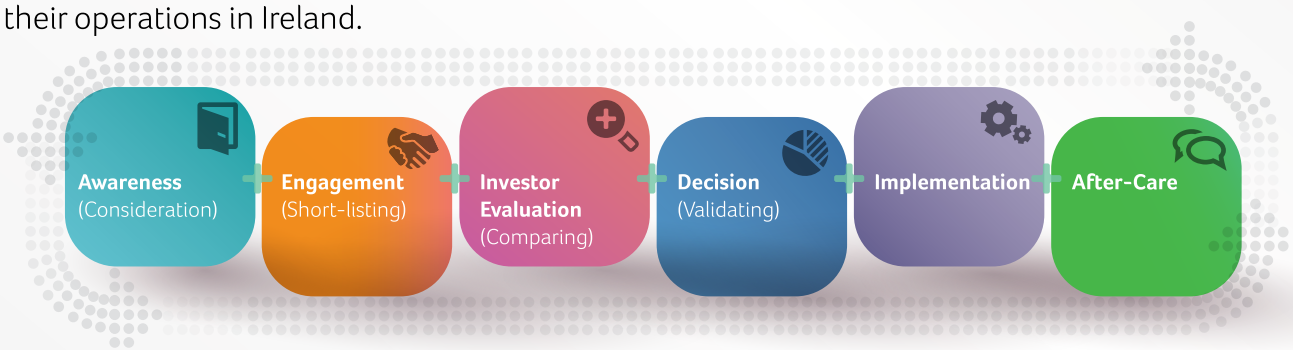

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  - Industry Associations
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LexisNexis Risk Solutions along with Cazana speeds access to UK vehicle data

LexisNexis® Risk Solutions in collaboration with Cazana, is bringing near real-time vehicle data such as valuation and insights related to MOT history into the quote and renewal process. This is alongside more than 42 further public and private data sources, through the LexisNexis® Informed Quotes platform. LexisNexis® Informed Quotes provides a swift, automated and more thorough understanding of risk through the data enrichment of over 220 million insurance quotes a day. This latest initiative will help give the market a more complete understanding of risk at point of quote whilst supporting vehicle validity checks.

The addition of Cazana data to LexisNexis Informed Quotes will help support right first-time quotes on new business, renewals and mid-term adjustments, by helping validate information supplied by the applicant whilst offering the potential to reduce the level of detail they may need to provide.

PARTNERSHIPS AND ALLIANCES

1. eSync Alliance and GENIVI Alliance collaborate on data standardization
2. Elektrobit and SUSE collaborate on automotive-grade Linux for China
3. Hino Motors, Ree Automotive partner to bring new technologies
4. ArcGIS users can now tap into Wejo mobility data
5. ekar integrates with CarPro to enable 500,000 rental cars
6. Motional joins vehicle cybersecurity forum Auto-ISAC
7. WM Motor chooses BlackBerry QNX for its W6 SUV
8. Macronix has been selected as Proactive Partner of Renesas R-Car Consortium 2020

Veoneer, emotion3D and AVL develop personalized restraint control technology

Veoneer, Inc., emotion3D, and AVL announced their collaboration to develop the personalized and situation-aware restraint control technology system.

A project nam. the European Commission's Horizon 2020 Fast Track to Innovation funding program. Over the next two years, the project partners will develop an innovative restraint control system able to personalize the actions of passive safety systems in event of a crash. Using a 3D sensor for understanding the vehicle interior, the system will consider a wide range of relevant, personal and situational factors such as body physique, position and pose, weight and gender.

Lyft sells self-driving tech unit to Toyota for $550m

Lyft is selling its autonomous vehicle division to Woven Planet Holdings, a subsidiary of Toyota. The Toyota's subsidiary will acquire Lyft's self-driving division, Level 5, for $550 million in cash, $200 million of which was provided to Lyft upfront. The rest of the money, $350 million, will be paid out to Lyft over five years. Additionally, Woven Planet and Lyft have signed commercial agreements for the utilization of the Lyft system and fleet data to accelerate the safety and commercialization of the automated-driving technology that Woven Planet will develop.

Vector and Wind River transform ADAS and autonomous driving

Wind River® is collaborating with Vector to deliver service-oriented architecture (SOA) capabilities for the development of advanced driver assistance systems and automated driving based on the AUTOSAR Adaptive standard to continuously enhance vehicle functionality and value over time.

The joint solution comprises Vector's AUTOSAR Adaptive technologies and the new Wind River Studio, which includes the VxWorks® real-time operating system (RTOS). Wind River Studio is the cloud-native platform. The combined solution will support safety-critical applications that require hard real-time, deterministic performance and allow auto manufacturers to deliver SOA components to address a mixed-criticality environment.

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Xiaomi announced its plan to launch first EV

Xiaomi had announced its plan to make smart electric vehicles. Lei Jun, the CEO of the Xiaomi Group, has revealed that the first EV will either be an SUV or a sedan, and that it will be priced within a range of CNY 100,000-300,000.

Jun's announcement of producing Xiaomi's first EV was based on a Weibo survey. Users were presented with an opinion poll regarding the kind of car they wanted Xiaomi to introduce first. According to Jun, around 45% of users voted for sedan, nearly 40% chose SUV, and the rest selected sports car or RV.

Jun has also discussed the use of the new Mi logo on the EV, noting that the new design is more suitable for the car than the older square version. One of the survey questions also discussed if Xiaomi should market the EV under its own brand or use another name. Close to 63% voted for Xiaomi to use its own brand name.

Huawei to invest $1 billion to develop EV and Self-Driving car technology

Huawei Technologies Co. will invest $1 billion for the development of self-driving and electric-car technologies. The company has already clarified that it has no plans to make its own car but will supply its tech to carmakers.

The company has already partnered with three automakers — BAIC Group, Chongqing Changan Automobile Co, and Guangzhou Automobile Group Co. Eric Xu, the rotating chairman of Huawei also revealed that the cars launched will carry the Huawei name as a sub-brand.

Huawei has already launched smart car connectivity products and the company's info and entertainment technology can already be found in Mercedes-Benz sedans. It has also teamed up with companies like BAIC BluePark New Energy Technology Co. to develop smart car systems and the first model under the partnership, the Arcfox αS HBT will be unveiled at Auto Shanghai in April.

Siemens charge controller and calibration kit for eMobility

Siemens offers charging system suppliers a new plug & play solution, which enables calibration of the Powerline signal level in line with CCS (Combined Charging System) CharIN Association Implementation Guidelines for the conductive charging of electric vehicles. The solution comprises the Simatic ET 200SP TM ECC PL ST charge controller and the TM ECC CCS calibration kit. When calibrating the signal quality of a DC CCS charge controller using the Siemens solution, there is no need for a spectrum analyzer, which makes the process quicker and easier.

Using the calibration kit, the charging system is calibrated as per CharIN Association recommendations to a transmission power of 75 dBm/Hz with a tolerance of +/- 3dB, which minimizes EMC (electromagnetic compatibility) problems. This ensures robust communication between the vehicle and the charging station.

GM and LG to spend $2.3 billion on second EV battery plant in U.S.

Ultium Cells LLC, a joint venture of LG Energy Solution and General Motors, announced, it will invest more than $2.3 billion in a second U.S. battery cell plant for electric vehicles in Tennessee. Ultium Cells will build the new plant on land leased from GM. The plant is scheduled to open in late 2023. Once operational, the facility will supply battery cells to GM's Spring Hill assembly plant.

The Spring Hill plant will use the most advanced and efficient battery cell manufacturing processes. The plant will be extremely flexible and able to adapt to ongoing advances in technology and materials.

Through Ultium Cells, LG Energy Solution and GM will merge their advanced technologies and capabilities to help accelerate automotive electrification.

Spark Minda partners with Ride Vision for ADAS technology for 2 wheelers

Minda Corporation has announced its partnership with Israel-based Ride Vision to bring its range of Artificial Intelligence-enabled Collision Avoidance Technology (CAT™) products for the Indian two-wheeler market for making the Indian road more safe.

Roads in India are known to be very busy with numerous vehicle types, unique road behavior and challenging maneuverability and Ride Vision's Collision Avoidance Technology (CAT™) has been uniquely built to address these challenges, specifically for two and three wheelers. Spark Minda's nation-wide reach and strong market share will make sure the product is successfully incorporated to the unique Indian market both as integrated into new motorbikes and in the aftermarket, to help fight the two-wheeler accident and fatality statistics.

Ola Electric to set up Hypercharger network across India

Ola Electric has announced plans to set up its Hypercharger network across India, over the course of the next five years. These charging stations will be exclusive to Ola Electric vehicles, starting with the Ola electric scooter that is expected to go on sale soon.

Ola Electric says it will set up 1,00,000 charging stations across 400 cities in India, as part of the Hypercharger network. It will be set up in a phased manner, beginning with 5,000 charging points across 100 cities in the first year. According to Ola, this capacity itself will double the existing electric vehicle charging infrastructure in the country. The plan is to set up these charging stations at places frequented by people, such as IT parks, malls and cafes.

Omega Seiki launches rapid charging electric 3-wheelers

Omega Seiki Pvt Ltd announced partnership with Log 9 Materials introducing rapid charging batteries for its Rage+ electric three-wheelers. The batteries will be first introduced in two variants – a 5.8 kWh, 120 Ah unit and a 6.5 kWh, 140 Ah battery which will take 30 minutes and 35 minutes, respectively to charge fully. The battery packs will have a 15-year warranty.

Both variants can operate in temperatures between -40°C and +65°C, making them perfect for Indian conditions. Developed by Log 9 Materials, these batteries will have 15,000 charge cycles, offering a range of about 65 to 100 km when fully charged.

Mahindra to continue supporting SsangYong's EV business

According to a recent report, Mahindra & Mahindra is planning to help out SsangYong Motor, even after the latter had filed for bankruptcy towards the end of last year. However, Mahindra's aid will seemingly be limited to just electric vehicles; the Indian automaker will supply the South Korean manufacturer with drivetrain for electric SUVs, based on the 'MESMA 350' platform.

MESMA stands for Mahindra Electric Scalable and Modular Architecture, and it has been developed completely in-house by the manufacturer. The platform is suitable for converting existing IC-engine vehicles to electric ones, as well as developing standalone EVs.

Last year, SsangYong had teased its first all-electric vehicle – E100. Based on SsangYong Tivoli, the E100 was expected to utilize the 'MESMA 350' platform and powertrain, and was previously supposed to launch in the South Korean market this year.

Automotive Telematics Market is projected to reach $320.6 billion by 2026: TMR Study

According to a new report published by Trends Market Research "Automotive Telematics Market by Channel (OEM and Aftermarket), Vehicle Type (Commercial Vehicle, Passenger Car, and Two-Wheeler), Application (Fleet/Asset Management, Navigation & Location-Based System, Infotainment System, Insurance Telematic, Safety & Security, V2X and Others), and Connectivity Solution (Embedded, Integrated Smartphones, and Tethered): Global Opportunity Analysis and Industry Forecast, 2019–2026

The automotive telematics market is segmented on the basis of channel type, vehicle type, connectivity solutions, application, and region. By channel type, it is bifurcated into OEM and aftermarket. By vehicle type, it is categorized into passenger, commercial vehicles, and two-wheeler. By application, it is classified into fleet/asset management, navigation & location-based system, infotainment system, insurance telematics, safety & security, V2X, others. By connectivity solution, it is divided into embedded, integrated smartphones, and tethered. Region-wise, it is analyzed across North America, Europe, Asia-Pacific, and LAMEA.

Key players in the report include Masternaut Limited, TomTom Telematics B. V, Trimble Inc., Omnitracs, VERIZON, I. D. Systems, Inc., Airbiquity Inc., Harman International Industries, Inc., MiX Telematics, Teletrac Navman, and CARTRACK.

Transport & Logistics Sector to Fuel Thailand's Connected Trucks Telematics Market

Reportlinker.com announces the release of the report "Transport & Logistics Sector to Fuel Thailand's Connected Trucks Telematics Market."

In 2015, Thailand's Department of Land Transport (DLT) introduced a program that mandates 6-wheel or above vehicles to install a telematics system, a driver card reader, and a driver monitoring system to verify the identity of the driver and monitor road safety practices. Data will be linked in real-time to the DLT's Transport Management Centre.

All public transportation vehicles and 10-wheel vehicles now must have telematics equipment, but the COVID-19 pandemic delayed expansion of the mandate to medium-duty trucks including the 6-wheeler segment until after 2021. Thailand's telematics market is well prepared for advanced technologies and state-of-the-art features such as advanced driver assistance systems and mobile digital video recording systems with quad high definition and ultra-high definition integrated with vehicle tracking and driver monitoring. This study reports the findings of a 2020 survey about the use of telematics and fleet management systems in commercial vehicles used for transport & logistics and postal & delivery services in Thailand. It provides additional analysis on customer perceptions, switching potential, and willingness to pay for services.

Connected Car technologies contributed to the reduction of accidents in the BALTIKA fleet by 55% in 2020

In 2020, the use of the Connected Car platform of the "Smart Driving Labs" (SDL) helped to reduce the number of accidents caused by drivers of the fleet of the Baltika Brewing Company (part of the Carlsberg Group) by 2.2 times. The fact that drivers began to drive more accurately than in 2019 when serious progress was noted, is evidenced by the scoring data and a decrease in the number of fines issued.

In 2020, the number of accidents involving Baltika Brewery vehicles decreased by 55%. At the same time, the share of accidents caused by the company's drivers decreased even more – by 2.2 times. The number of fines received also decreased – by 57%, and their amount-by 64%. That is, drivers not only violate traffic rules less often generally but also committed fewer serious ones.

The statistics collected by Element telematics system confirm that the improvement in performance is not due to a reduction in the average mileage per car (decreased in 2020 by about 12%), but to more responsible driving. The penalty score calculated by the Element (the scoring system works on the basis of data on dangerous maneuvers and speeding) is reduced for the third year in a row. In 2019, Baltika drivers averaged 22 penalty points per 100 km of mileage, in 2020 this figure fell to 19.2, and since the beginning of this year, it has remained at 9.4. The most noticeable reduction in the number of speed violations in 2020 was the average number of Baltika drivers who committed 1.9 such violations per 100 km of mileage, while in 2019 this figure was 2.5.

Element tracks the movement of corporate transport, driving safety, the time spent by drivers behind the wheel, fuel consumption and maintenance time. In addition, the system records and notifies the responsible employees of Baltika in real time about the accident and, if necessary, creates 3D reports on the accident. Such reports help to identify the culprit and can be used in cooperation with the insurance company.

SDL and Baltika have been cooperating since 2019. In addition to the installation of telematics systems and the corresponding software, the Element system was integrated with Alcolock, which, starting from 2019, is standard equipment at all cars purchased by Baltika. The system allows you to remotely monitor the sobriety of employees. Before starting the engine, the driver must pass a breathalyzer test. If the concentration of ethyl alcohol vapor exceeds the norm, the system blocks the engine, the data is sent to the SDL server, and then is reported to Baltika.

In 2020, the companies significantly expanded their cooperation. During the year, the number of Baltika cars connected to the SDL Connected Car platform increased by 58%, exceeding two thousand units.

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20+ Countries

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