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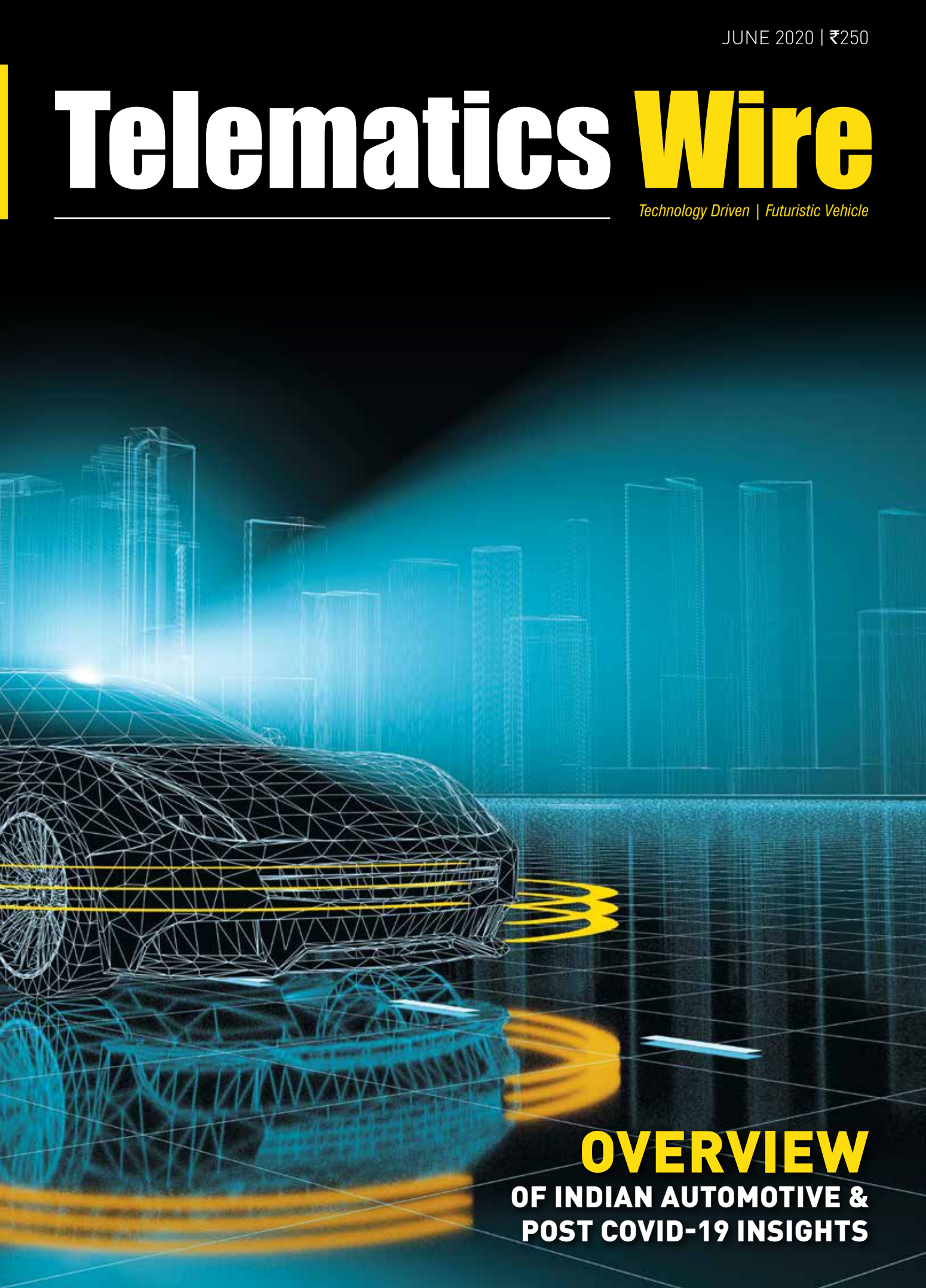

OVERVIEW

OF INDIAN AUTOMOTIVE & POST COVID-19 INSIGHTS

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Crisis breeds opportunity. One day it will breed thought leadership!

MANEESH PRASAD
CEO & EDITOR
TELEMATICS WIRE

COVID-19 saw an unprecedented crisis unfolding and engulfing one country after another. Countries across the world went into state of lockdown. General public health emergency came up and governments across the world responded to it by putting resources to manage it from few percent of their GDP to over 10% of GDP. The Government of India too responded to the crisis in a pragmatic way, balancing the fiscal deficit and crisis management. About 20 lakh crore (~US $ 267 billion) has been allocated for managing the crisis.Slew of policyreforms and intent for reforms in some areas, were also announced in mid-May 2020.

Though a lot is being being, little more could have been done for the automotive industry, which contributes nearly half to the country's gross manufacturing. Knowing fully well that there are best and brightest of the brains working 24 x 7 x 365 in government and its think-tanks, we still would like to present our 2 cents-

Being **Contemporary**, has been an easier way out. In the fast changing world one should not remain isolated with ideas and ideology which has not evolved through open and fair deliberation. The developed economies are fast moving to connected and autonomous vehicle, through endorsement and investment in connected and autonomous vehicle test sites and suitable policies changes/formulation, paving the way for industry to transform into futuristic automotive by the beginning of 2030s. Time is now to look into it with inclusive and earnest approach by all stake holders, which will give the ecosystem an impetus to evolve and graduate to new level, rather than wait for another 4-5 years and change of guard comes up with a timeline which makes automakers and their partners miserable, or else we end end up losing completely on the opportunities of futuristic vehicle. Moreover considering that our logistics ranks one of the costliest in the world and it is further indifficult situation due to shortage of drivers.Nearly 30% of trucks at any point of time are lying idle for want of driver. Platooning of semi-autonomous vehicle which is expected to be a reality in coming 4-5 years could be possible solution for shortage of drivers. The shortage of truck drivers will continue, until we start paying truck drivers like airline pilots and there is queue outside transporters' offices of drivers willing to take up the job.

There can be a silver lining in this dark cloud- At times crisis leads to **change in the way we think and operate.** Be it South Korean telecom managing its packaging and logistics through autonomous vehicle or Sharjah distributing the medical equipments/supplies to localities through autonomous vehicle. We have were not behind in global race for mastering vehicle autonomy and robotics, we could have used autonomous vehicle with suitable identification mechanism to distribute the relief supplies. Something analogous to direct benefit transfer which does not have any person in between, for reasons known. There are indigenous companies which could have provided such systems and taken the relief distribution mechanism to higher level of secured and comprehensive distribution.

Fast tracking Charging Infrastructure for EVs- The government intent as in FAME 1 and FAME 2 has been appreciated by all. EV needs charging infrastructure and in size which is phenomenally huge, notwithstanding the enormity of efforts and resources needed, we still think it is doable in reasonable time frame. It could possibly be achieved by connecting the dots between the large number of micro-entrepreneur and the need to setup the EV charging infra, through policy tweak, financial assistance etc.;encouraging public parking, residential parking and office parking to have EV charging points. Mandating municipal corporations/RWAs to have charging points on roadside where vehicles are parked/ can halt for charging. A small fraction of economic package could have changed the face of charging infrastructure, at least in major cities of the India to begin with.

Vehicle scrapping policy- Going by market research firms analysis, suitable vehicle scrapping policy, can lead to 10million vehicles going off the road in next two years and if these were to be replaced by news ones, it will surely bring the automotive sector and in turn country's half gross manufacturing back on track and perhaps on growth path in short time frame. Government may do well to link this with green initiative of electric vehicles, as many of the European countries had done in 2007-09 crisis. The cost analysis of implementing this would surely be with the government agencies, but as a commoner, even if the 10 million vehicles are passenger vehicle with government supporting the replacement by spending on an average 100k for each one of them, it will be just about 5% of government spending to fight COVID-19 economic downward impact. At 5% of what government has lined up for fighting the economic slowdown, it will bring half of country's gross production back on track. On top of this the GST and other tax realisation which government will receive for additional new vehicle sold may even bring down the actual cost to 3% - 4% of what government has setup as war chest to fight the slowdown due to pandemic.

AN OVERVIEW OF INDIAN AUTOMOTIVE SECTOR AND POST COVID-19 INSIGHTS FROM INDUSTRY LEADERS

MANEESH PRASAD
TELEMATICS WIRE

Indian automobile has grown in size over the last couple of decades and it was 5th largest automobile market in world at 3.4 million units in FY19 closing. The automotive industry in India, including commercial vehicles, two wheelers and three wheelers contribute about 7.1% to the GDP and if we look at manufacturing, automotive contributes 45% of gross manufacturing. According to Statista Research Department, the automotive sector in India employed 1.3 million people in 2017. Overall, automotive is an important segment for economy and employment in India.

In 2016, government of India announced that it will skip BS5 and move to BS6 from April 2020. Considering that industry was required to comply with BS4 from April 2017, it was a tough time ahead for industry, both automakers and components industry. According to ACMA, the components industry has invested about 30,000 crores (nearly US$4 billion) and automakers had to invest about 40,000 crores(US$ 5.3 Billion) to comply with BS6 norms. Coupled with the government push for electric vehicle and intent to phase out manufacturing of fossil fuel based engine by 2030 for all kinds of vehicle, automakers needs to have right strategies in place.

Specific to our vehicle telematics industry, IS 16833 or what is commonly referred to as AIS 140 was mandated from 1st April 2018. (Please refer our earlier article on AIS 140 in Smart Automotive, May June 2018). 17 days into the notification, the mandate to use vehicle tracking device in public transport vehicle was withdrawn, leaving many of the vehicle telematics service provider with tracking devices inventory and no takers. Going forward from January 2019, common layer was developed by DIMTS and an industry association formed in December 2018, which was not mandated through any directive, but became a norm for the vehicle telematics service providers.

In November 2016, government demonetised 500 and 1000 currencies, which though had short term impact, but couple of month later, the sales of passenger cars and others were on growth path. From July 2017 Goods and Services Tax(GST) was introduced in India, which was expected to reduce the cost of vehicle (end product) which has helped move the taxation at par with countries considered to have good indirect tax structure(PwC, Feb'2019). In 2018, Government introduced revised slab for GVW 2-axle, 3-axle and 5-axle trucks aiming to reduce the cost of logistics by 2%, but somewhere impacting the sale of commercial vehicle in short run.

Glimpse of Manufacturing

Manufacturing of vehicle in India has a long and complex supply chain, with the manufacturers to large extent confined to complex assembling of parts. These parts are also sourced from within and outside the country. Almost US$ 4.5 billion of parts was imported from China in 2018-19, which was 27% of automotive parts.

Impact post COVID-19

Post lockdown in March 2020, the month of April'20 registered zero sales for the Indian auto sector, which highlights the magnitude of blow which automakers are facing. According to SIAM the automakers would have had an impact of about INR 2300 crores (US$ 310 million) everyday due to lockdown. With lockdown easing and government eager to facilitate the start of production at manufacturing and other sectors from mid May'20, hopefully the supply chains which was disrupted over the last couple of months, will be back to its desired production level by July-August 2020.

In a recently published article in Economic Times, Hetal Gandhi, Director, CRISIL Research, had said that the auto sector would go back by 3 to 10 years, with segments like cars, utility vehicle and commercial vehicles possibly going down to FY11 level.

Shared mobility & personnel vehicle ownership

In the post COVID-19 situation many of the industry experts have opined in articles in public domain that there will be decline in usage of shared mobility. Anticipating this shared mobility service providers like Ola, Uber, Yulu, Rapido and others are working out new offerings by restructuring their existing service portfolio (Economic Times, May 2020). These companies are also apprehensive of low cost last mile connectivity like rickshaws and also self drive options to eat into their existing market. It is expected that it may take over a year and half for shared mobility to come back to its normal self. Possibility of new business model, like an extremely flexible and affordable self drive model which appeals to large segment and is widely adopted by the consumer too, cannot be ruled out.

Work from home

Though the apprehension to use shared cabs or public transport vehicle will continue for some time, but, the downward slide in usage of shared cabs may not result in steep rise in personal car sales. 'Work from Home' has emerged in a new avatar for many sectors, including IT, software development, financial services etc which may see a new order in post COVID-19 where people are encouraged to work from home. TCS can be a case here which has declared its intent to institutionalise WFH with almost

75% of workforce following it. This would leave just those taking care of backend hardware, infrastructure and important meeting being done in office. In short term, public transport commute is expected to go down significantly even if the lockdown is removed completely. There are indications from survey carried out and mentioned in articles(Deccan Chronicle, May20), personal vehicle ownership which was on decline amongst the millennial may see a shift towards ownership of vehicle and that in short run over the next quarter after or so. In long run, 'work from home' culture is bound to leave an impression on companies and their personnel's mobility psyche. There is a likelihood that companies could come up with a reduced office workspace and individual required to commute to office on need basis.

Manpower availability for shop floor & disruption of transport & logistics

Automakers and component manufacturers have substantial percentage of contractual workforce.

They may face some degree of man power shortage, due to large scale movement of labourers and workers fearing pandemic back to their native states. The workforce present would have concern about their own health and workplace hygiene. Reports of workforce testing positive (in 4th week of May) at Hyundai's Chennai plant and at MSIL Manesar plant, just couple of weeks after the operations resumed in early May20, are indicators that kickstarting manufacturing plant will need adherence to few more "dos and don'ts". On the other hand, going by the statement of Harbhajan Singh, Chairman- Ease of Doing Business, CII, Haryana, 2-3 million contractual workers out of 6million, may lose their job in Gurgaon-Manesar-Palwal belt due to weak demand for automotive in post COVID19 phase. (The Hindu, 24 May'20)

Transport industry was already under stress of shortage of driver, according to Ramesh Agarwal, Chairman AITWA, in his address in Vehicle Telematics conference at Delhi last year, mentioned that about 30% trucks are lying idle because of lack of drivers. Truck driver as a profession is pursued by unskilled worker who only prefer this over being daily labourer. Moreover the state of truck driver, moving the goods across the country is pitiable; considering the lack of infrastructure for their break from drive, like basic amenities to retire and refresh during the journey. COVID19 will only add to the misery of transporters, where in near future, shortage of driver will become more alarming.

Online sales of vehicle

Allow me to go back couple if decades. Mid 90s, laptops were expensive office equipment and purchased after negotiations with the seller and its physical verification. It would have been difficult to think of buying a laptop through telephone or Internet(which was slowly making its presence than). Fast forward into mid 2000, we started buying books from online stores, but still mobile phones and home equipments were purchased at retail outlets. This changed dramatically over the next 12-13 years. One gets best deals online and are mostly brought over too in urban area. It's time for paradigm shift in way we purchased our vehicle. Having spoken to few of the people, they think the sweet deals which they get buying an electronic device online may happen in vehicle purchase too. Direct transfer of discounts, goodies and service support will only improve with online sales. Its going to be journey and there will be many lessons learnt for the manufacturers and online dealers, as we would slowly start moving from 25,000 dealer across the country generating business worth over 7 lakh crores (US$100 billion). The first space for online sales maybe be created by those who would succumb in this COVID19 crisis and the fear amongst the existing strong players to refrain from quickly expanding in the vacated space. It is expected that almost 5% of existing vehicle dealers would find it difficult to remain in business. According to Federation of Automobile Dealers Associations (FADA), COVID 19 has hit the dealership industry when it was looking at recovery after past 15 months of slowdown and about 275 dealership may shut down.

In our country the buyers psyche is driven by discounts and economics, in other words getting the best deal in the market. The discount offered during festive season generates 40% of sales. With online sales and discounts being made transparently across a given region or pan India the sales may spread over to non festive months too. Direct link between the customers and manufactures may lead to win win for both and dealers may do good as final point of despatch to end customer and continue as provider of service post sales.

But not all would agree to the paradigm shift to digital sales. In an interview published in Financial Express on 25 May'20, Balbir Singh Dhillon, Head, Audi India, mentioned over there, that though Audi was one of the early mover in this space with myAudi connect, but logical next step would be to go "phygital" sales experience for customer, which is a mixture of physical and digital. Also, he does not consider vehicle dealership as middlemen but as partners. This view can also generalised to a perception where the automakers may not like to ruffle the feathers of dealership as of now.

Hazy days for startups

Many of the articles and industry reports predict difficult time in coming days for the startups; with electric vehicle segment being hit more as they were being funded OEM's and funding agencies investors. There is a possibility that they may start pulling the string of their purse in such time. Technology development may survive through aquihire, but those vending plug and play vehicle may find difficult going forward.

Crisis and Government Push

Government policy push is important in such crisis as it provides the much needed push to bring the sector back on its growth path. If we look into crisis of recent past in 2007-2009, most of the countries which introduced vehicle scrapage policy, linked it with clean energy, for improved environment. In our context, MoRTH released in October 2019, the draft guidelines for setting, operation and authorisation of vehicle scrapping facility(AVSF). Broadly it talks about the compliance and provisions for scrapping a vehicle(End of life vehicle, ELV). Going by the recent indications of Honourable Minister Shri Gadkari ji, the vehicle scraping policy for India will soon see the light. The commercial vehicle segment in India, which according to ICRA could see 8-10% contraction in FY21(April'20-March'21) could benefit from scrapping of ELV. Although PwC expects even more steep fall in sales for

FY21, 18% for two wheelers, 12% for passenger cars and 21% for commercial vehicles. According to PWC, there will be downgrading by buyers, where the buyers goes a segment lower in personal vehicle(four wheeler or two wheelers) to what one would have earlier brought. Hence extending the vehicle scrapage policy to passenger cars and two wheeler may breathe life to automotive industry which contributes almost half of the gross manufacturing of India.

Government has been pushing the usage of electric vehicle and has incentivised its usage through FAME 1 and FAME 2. The intent and willingness has been exhibited in successive plan for pushing electric vehicle in India. One way could also be through connecting the small and micro entrepreneur with the charging infrastructure, by showing successful return on investment. Wishful thinking charging infrastructure mushrooming across the country much like the PCOs of yesteryear telecom days, perhaps a some policy tweak may connect the dotted line between the phenomenal demand of charging infrastructure and micro entrepreneur of this country.

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ANUP PATIL

CEO
INTANGLES

KIRTI NAIR

DIRECTOR SALES & MARKETING
UNISEM

How will the COVID19 impact the vehicle telematics service providers in India?

Anup Patil: Post Covid 19, we believe that the vehicle telematics market will have a stronger acceptance by the fleet operators as more than ever there will be need for Operations Optimisation and Fuel Monitoring. With less resources at hand fleet operators will no longer have the luxury to deploy resources to manage the fleet. Better tracking of assets and growing push in the manufacturing sector will give a significant thrust to Logistics sector.

Kirti Nair: The basic vehicle tracking device market will growmore than the feature heavy vehicle telematics device, as people buying habits may change in short run. However the AIS140device compliant vehicle tracking device will have a surge with Govt consumption.

Do you think there will be shift in buying trend from the private transporters, fleet owners, state transport corporations other industry players?

Anup Patil: Private players will be cautious in buying new vehicles and it will take at least couple of quarters for the market to turn bullish, unless government announces few SOPs for the fleet operators.

Kirti Nair: Usage in private transport may come down, but the logistics industry will grow by leaps and bounds within 8-9 months post lockdown. Retail customers may stay away from buying telematics device for their cars in the initial days but over a period of one year these things will get normalised.

What is bigger issue for the telematics service providers- disruption in supply chain due to break in manufacturing or TSPs stuck with inventory with no buyers?

Anup Patil: For Intangles it has been the break in supply chain of components and shutdown of manufacturers due to lockdown.

Kirti Nair: That's a challenge however the normalisation process may take 6-8 months there will be consolidation by large system integrators.

Will there be new normal for vehicle telematics industry or we will quickly get back to our previous order in a quarter or two?

Anup Patil: The market will take time to pick up the pace, but post first two quarters market will pick up pace in terms of orders. Till then fleet operators will be more cautious in their spend and also focus more on meeting the tighter guidelines prescribed under social distancing

Kirti Nair: The market will restart with two-wheelers/electric vehicle telematics,the higher end automotive telematics which was the buzz word may take a back seat for sometime as self-driven two-wheeler /small car market segment will grow.

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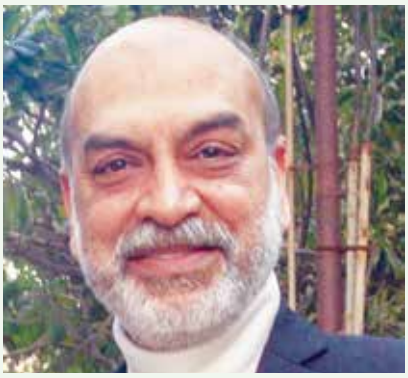

MANISH PATEL
CIO
MG MOTOR INDIA

Will pandemic impact the introduction of new technologies in vehicles to be launched in coming years?

I would say there will be a course correction for newer technologies both from a manufacturing and retail perspective. In fact we would now be looking at technologies which could be more relevant during Pandemic's like the recent one. One of the technologies we're very close to deploying is contact less delivery of our vehicles to customers from dealerships. Right from booking to selecting accessories to making an online payment to the dealer. Even start-ups would take a breath, and would start thinking of newer technologies around automobiles for solutions around pandemics like the recent one.

Do you anticipate reduction in R&D spend in MG at parent company?

Again as I said, we do not intend to reduce the R&D spend at MG. Certainly there will course corrections towards facilitating more relevant solutions keeping the current Pandemic and any future pandemics in mind.

Will there be a shift in buying pattern/behaviour, because of low liquidity in buyers' hands?

Certainly there will be a shift in buying pattern / behaviour. I truly believe vehicle sharing, vehicle leasing for a shorter time (e.g. less than 6 months) compared to the standard 3 to 5 years, shift from gasoline or diesel to electric vehicles are all potential of pattern that we could see shift.

Can there be a monitoring system for managing the hygiene/ disinfectant in public transport/ shared transport?

More so from a public transport system, the entire cycle of people wanting to travel would change. Be it bus or railways or flights. The entire ecosystem or cycle of travel would change. Less and less human intervention can be expected. However the bigger challenge is how to educate the normal or less or uneducated people?

What policy change can revive the demand for automotive? Will vehicle scrap policy (yet to be announced) be a game changer in Indian context?

One possible change would be shift of customers from gasoline or diesel vehicles to electric. The adoption rate including the cost is challenging from our country perspective. However if this shift and affordability happens we could see a lot of customers change to electric vehicles. Scrap policy alone is not going to drive the demand for automobiles. Again 80% of vehicles bought in India are financed. Can the loans be made more affordable or a monetary benefit to a person who is owning a vehicle which is 10 years or more be given incentives to shift to a new vehicle.

ASHISH SAMANT
CHIEF EXECUTIVE
ZEN MICROSYSTEMS

How has lockdown affected Zen Microsystems?

COVID-19 lockdown has created a deep impact on our business, as all our work is field work, and we are unable to travel and visit customers for System Installation and Training. We have received and finalised few orders over the last two months and we expect more to come after lockdown, but we are unable to executive them. Even our foreign principals from UK, Germany & France are in lockdown.

What is the challenge in post Covid 19?

The biggest challenge we will be facing is to get business. Few companies already postponed their purchase activities. Order execution will also be a challenge for us as we will not able to travel to the customer site for installation & training. Fortunately all are customers are conversant with our products and we can guide them over phone and do online hardware & software training.

The testing projects which we take up has been badly affected due to lockdown. Running of vehicles was not permissible and also safety security of riders & drivers was a concern.

What will be the impact on ADAS business?

ADAS technology is just in the beginning phase and very new to Indian market. There are many companies in India who are developing partnerships with European companies, their projects may get delayed or cancelled. We are also desperately awaiting the demand of ADAS testing in India.

Do you foresee any change in R&D & testing of new products etc?

Yes, there will be a change in the spending on R&D's; as there will be limited capital budgeteer it. Spending on testing projects may be curtailed, but we are hopeful about the need for extensive testing of existing and new prototypes for the automakers.

Do you think policies can help automotive get back in driving seat?

Yes, Govt have launched very big package for the MSME's to become self-reliant. We are sure that this will help the auto ancillaries & OEM's to grow fast. Coming back into the driver seat will take some time, but we are very confident about this.

SANJAY DHAR
DIRECTOR & COUNTRY ENGINEERING HEAD, ELEKTROBIT

What is the impact of slowdown in automotive industry for technology developers and integrators?

The automotive industry across the world is in the midst of a transformation. Vehicles are seeing more software content being integrated into them. Connectivity is a common feature among cars and other vehicles, which means the scope for technology developers and integrators is massive.

While the slowdown has affected the industry across the board, we must remember a major evolution is happening, and this requires time - for all stakeholders to align to a change. As technology developers, we see this as another opportunity to innovate and grow. The R&D continues at the same pace, and we look to the future where we can bring in more technologies

What do you expect as short term impact on business/industry?

From an industry perspective, these are unprecedented times. April 2020 recorded nil sales for the first time in history. This was also a critical transformation time, where BS VI norms should have commenced from 01 April 2020. Some of these deadlines have been pushed back, so the industry is reconciling with the 'new normal'.The slowdown could mean that the implementation timeline of some technologies could be delayed but R&D still continues at a strong pace. As the industry recovers, we will have newer technologies ready to deploy as and when the markets are ready for it.

Do you foresee any change in consumer behaviour in near term?

The consumer in India, and across the world, is becoming more discretionary. Cars are no longer viewed as just transportation devices. There is a whole lot of comfort and personalization involved in a vehicle. We will see a higher demand in customization in the near-term, where a consumer might choose for a certain set of features only. For eg. we might see an uptake on features that are health related, no touch based systems (voice, actions, haptics). This behavior will continue to evolve over the long-term, where a host of optional features will be offered by OEMs. Overall consumer expectation will be all about what feature rich product you get for a given price range.

Will there be any shift in direction from electric and shared to something like small and self-drive for the millennials?

While the startups in the electric mobility space are finding it extremely challenging to survive due to cash crush and lack of financial support in such extraordinary and unprecedented times, we do not foresee any impact on the demand for the electric mobility as the attention is currently on building sustainable mobility - which, for now, means electric.Going forward social distancing will become a norm and hence people would prefer private transport against public or shared transport. Hence there could be an increase in demand for small cars and two wheelers which could potentially have an impact on the shared mobility.

What can hasten the pick-up of this automotive industry?

As markets begin to recover and disposable incomes increase, we will see a growth in the automotive industry as well. The entry of newer features, a range of electric vehicles will also give the customer a range of options that suitable for the future as well. Industry policies will have a great deal of impact too, especially on the topics such as unsold stock of BS IV vehicles and the proposed scrappage policy.

In the absence of any government support how can industry play a role in automotive industry get back on track?

The industry is well represented by associations such as SIAM, ACMA, and other related bodies. These associations have a vital role to play in setting a structure for the industry to follow and negotiate with the government too.

Impact of Coronavirus outbreak on businesses for Telematics Service Providers in India?

We believe that while there might be an impact in the short term however, we do not foresee any impact in the longer run as demands for telematics services will only increase. The buying pattern of the consumers suggests that they are inclined towards new products/ features (sale of MG Hector and KIA Seltos are case in point). Moreover, the demands for health, safety and distancing related features might see an increase in demand.

Do you think there will be opportunities that connected vehicle will create post corona pandemic?

Connected vehicles are the future. Connected vehicles offer more safety and comfort features and have already been in high demand. Most new cars on the road have some elements of connectivity.

We could expect this to grow further, a s this could enable more options for contactless interactions between humans and surrounding infrastructure, humans-to-humans and enhance comfort and safety levels in the post-COVID world.

What will be the strategy from survival to revival for automotive, CV, AV, Telematics, suppliers industry etc., post COVID-19?

We will see consolidations and formation of JVs going forward that will play a pivotal role in fueling the revival

MANDEEPSINGH K
EXECUTIVE DIRECTOR
POINTER TELOCATION INDIA PVT LTD

Mobility of people, vehicles, goods has fallen significantly due to COVID and it continues to be a global pattern. This is having a direct and significant impact on vehicle telematics whose primary purpose continues to be tracking of movements! It's a fact that India is a place of low ARPU (Average Revenue Per User), pickup any subscription based service like, Entertainment platforms, Newspapers, Delivery services, vehicle rental, telecom etc cost of service is heavily discounted in lieu of volumes. And inspite of volumes we have seen companies facing challenges and often suffering losses. Vehicle telematics is no different, I can say with confidence that no subscription service in India has as many providers as Vehicle telematics. Its extremely fragmented, crowded and dominated by track and trace providers. I believe its this segment of Vehicle telematics that would see the most struggle. Companies providing value added solutions, meaningful data analysis, asset and vehicle health monitoring, are in better position to weather this storm. COVID situation might change telematics industry for good, industry might relook at ARPU, technology upgrade and move beyond track and trace solutions.

Everybody has a plan till you get punched in the face, that's how I see COVID crises. It has been a knockout blow, nobody prepared for such eventuality. Demand for hardware fell off the cliff as customers took a step back, took time to get a grip on changing business environment and froze all capital expenditures. Taxis, car rentals, commercial vehicles, scooter rentals, entire mobility business came to a standstill leaving no scope for telematics hardware installations. Service aspect of telematics also bore the brunt. As we moved deeper into lockdown, large number of users started putting their subscriptions in suspension or in some cases cancelling it altogether.

Lockdown is still in force, each state has its own set of restrictions. Unless there is uniformity atleast with regards to business activities the cylinders of economy wont fire to its potential. We have experienced that users and telematics companies are utilizing this time to evaluate, focus on technology adopted by them, making it more efficient, scalable and incorporating more value additions to comeback strong and enhance customer experience, this is a positive trend. We feel it could take atleast 3 to 4 months to reach a "new normal".

Telematics is visibility and it has become a business need, so demand for new telematics installations would continue in proportion to movements of goods. Various Government institutions, PSUs have telematics initiatives which started before COVID, we expect those projects to gather momentum. These projects have a great potential to accelerate recovery of vehicle telematics. As vehicles start moving users would need visibility of their fleet and service part of industry shall recover much faster compared to hardware telematics. New installations of hardware would remain a challenge in short term. Installers have returned to their home towns and the ones available are hesitant to go on field out of fear.

Industry has a lot to learn from this crisis. Increase in ARPU, investment in better technol-ogies both in terms of hardware and software, enhancing user experience through value added solutions are some of the takeaways. Strategy of predatory pricing at the cost of compromised services has hurt a many in the industry. I believe COVID crisis has given time to retrospect. The lessons learnt would instil sanity and focus will shift from price to value.

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AUTOMOTIVE ANALYST VIEWS ABOUT THE INDUSTRY DURING AND POST COVID-19

What will be the impact of slowdown in the automotive industry and what do you expect as short term impact on business/industry?

With the COVID-19 pandemic breaking out in China at the beginning of the year, vulnerabilities in the global automotive supply chain were exposed, with nearly 85% of the world's supplies dependent on China in some way or another. The ripple effect was felt globally, and most auto manufacturing came to a sudden halt as lockdowns shut plants at home.

Even before the pandemic, the industry was stressed financially from increased emissions related upgrade costs and increased R&D investments in emerging technologies. As manufacturing operations resume, the added burden of COVID-19 safety protocol compliance, plummeting demand, and inefficiencies from underutilized capacity are further exposing OEMs and suppliers to severe liquidity issues. Further disruptions are likely to continue, bringing the possibility of major consequences to specific segments of the auto ecosystem.

With most regions remaining vulnerable to lowered customer demand, Counterpoint expects substantial volume drops in 2020. For example, in the major markets of North America and Europe, we expect base case sales of 13.4 m and 13.6 m, a YoY decline of 24.1 % and 25.7%, respectively.

In India, with the extended lockdown of all showrooms and manufacturing facilities, the Indian auto industry saw zero production and sales in passenger and commercial vehicles (PVs and CVs) in April, which followed March's 50% and 88% drop in PVs and CVs, respectively.

VINAY PIPARSANIA , CONSULTING DIRECTOR - AUTOMOTIVE, COUNTERPOINT RESEARCH

The largest carmaker in India, Maruti Suzuki, only managed export shipments of 632 units during the month with port operations having been partially resumed. Similarly, exports of Hyundai and Mahindra stood at 1,341 and 733 units respectively last month, while having reported zero domestic production and sales. Compared to April 2019, when the country had reports total PV sales at around 320,000 and exports at 56,800 unit, the current lockdown will surely leave some deep economic wounds. With the partial opening of a few plants allowed in May subject to strict safety, sanitization and social distancing protocols, every auto manufacturer is now frantically working with dealers and supplier partners to rebuild the ecosystem.

The auto industry in India has already undergone considerable slowdown over the past 12-18 months due to structural changes beginning with goods and services tax (GST), shift to shared mobility, axleload reforms, the BS-IV to BS-VI transition and liquidity crunch. With no clear definitive indication of when the social and economic conditions in the country will get back to normal, Counterpoint is holding to its base case scenario of 20% YoY decline in auto sales, and a worst case outlook to a 35% YoY decline should the GDP growth outlook become negative.

Do you anticipate reduction in R&D spend by automotive OEMs?

Yes. It is most likely that as an immediate and urgent response, companies will resort to redeploying their R&D funding to sustain core operations, potentially setting back the progress they have made on alternative fuel and mobility technologies by several months to a year. Some companies may even choose to take a strategic call to discontinue unstainable models and exit certain vehicle categories altogether.

In our view, as the world and customers moves towards a new post COVID-19 reality, auto companies will look to reprioritize their focus on upgrading plant automation, manufacturing productivity and efficiency with Industry 4.0, and putting further resources in developing online sales channels – delivering digital showrooms, VR solutions, and touchless delivery.

Will pandemic impact the introduction of new technologies in vehicles to be launched?

Certainly the advancements in electric vehicles is one of them.

In the short term, current oil prices will delay adoption of EV platforms by customers. However over the medium and longer term there will continue to be concerted efforts by Government and stakeholders to drive EV adoption and growth in India. With automakers and suppliers currently already deeply invested in conventional internal combustion engine technologies, they would surely reconsider and avoid diverting any funds towards the electric vehicles segment at this time with the imminent economic downturn.

It has been reported that Automobile OEMs in India have already invested around Rs 40,000 crore (US$ 5.3 billion) to upgrade their facilities and products, while the auto component industry has invested another Rs 30,000 crore (US$ 4.0 billion) to develop mandated BS-VI emissions technology. Electric cars could take a back seat for at least one year with the current disposition to revert and hold onto conventional ICE technologies.

In these uncertain times, consumers are cutting discretionary expenses and savings are being channelized to health and hygiene areas. Consumers will look to postpone big ticket purchases, especially in the personal mobility space, and opt for affordable options instead. Traditional cars and two wheelers are 30 to 40 percent cheaper than their electric counterparts.

Will there be a shift in buying pattern/behaviour?

The COVID-19 outbreak and resulting economic uncertainty has dampened consumer demand in the short term, leading to declining new vehicle sales with deferred spending on nonessential items. In the long run, these forces could also trigger a shift in consumer preferences, as experienced in the past with earlier global events having significant economic impacts e.g., wars, oil price volatility, bank failures etc.

With purchases in many countries happening mostly online while under lockdowns, potential car buyers have become familiar and comfortable to the idea of buying cars online too. Auto dealers have enhanced their online selling skills, using unconventional ways to communicate with car buyers, such as Zoom video calls and WhatsApp for instance. Initial industry feedback has been somewhat surprising, revealing an overall satisfactory buying experience, comparable to walkins. We are seeing more and more dealers ramping up their websites to help buyers preselect and book desired models, process payments and complete related paperwork digitally.

While car sales have traditionally been a single, decentralised sales channel, i.e. automakers/importers sell cars to dealers, and dealers to consumers; COVID-19 is rapidly shifting this dynamic towards going directly digital with the OEMs.

Mercedes Benz has announced plans to convert 25% of its global sales online by 2025, and longer term, it is likely some auto makers may consider adopting a Teslalike business model, going fully online and delivering directly, removing the dealership from the equation.

Counterpoint analysts believe though that many car buyers will continue to want a bricks and mortar experience, preferring to kick the tires and test drive for themselves before buying. Dealerships will continue to account for a vast majority of cars sold globally during the next decade.

However, with social distancing becoming a way of life, contactless delivery will undoubtedly become an important delivery approach for almost everything, including cars.

> **"POST COVID-19 AUTO COMPANIES WILL LOOK TO REPRIORITISE THEIR FOCUS ON UPGRADING PLANT AUTOMATION, MANUFACTURING PRODUCTIVITY AND EFFICIENCY WITH INDUSTRY 4.0"**

What policy change can revive the demand for automotive? Will vehicle scrap policy (yet to be announced) be a game changer in Indian context?

An immediate relief measure which the government could consider is reducing GST for automobiles, at least for a limited period. As the demand ramps up, the revenue shortfall could be recovered.

Other policy support would be the deferment of certain regulatory norms and making available working capital at subsidised rates to automotive suppliers and dealers, while allowing a smooth seamless transportation of goods across the country once the lockdown is lifted. These would help resolve any automotive supply chain disruptions.

Yes, a well defined vehicle scrappage policy covering all segments, including cars and two wheelers and not just commercial vehicles, can help create an industry of its own with a business opportunity reported to be in the range of $6 billion (Rs 45,000 crore) annually. It would generate employment

opportunities, contributing to economic growth, and has been a consistent ask by automotive stakeholders in the country as a critical factor to facilitate revival of new vehicle demand.

In addition recycling of metals like steel, copper and aluminium from scrapped vehicles could reduce the imports of such commodities. Ensuring older vehicles are off the road will help lower pollution levels in the country, with modern full efficient and low emission vehicles replacing them.

Should the Indian scrappage policy be well defined and rolled out immediately, Counterpoint estimates that around 10 million vehicles could go off roads by 2022 and nearly 20 million by 2025.

> **SHOULD THE INDIAN VEHICLE SCRAPAGE POLICY BE ROLLED OUT IMMEDIATELY, AROUND 10 MILLION OLD VEHICLES WILL GO OFF ROAD BY 2022 AND 20 MILLION BY 2025**

Auto manufacturers, namely Maruti Suzuki and Mahindra & Mahindra have already ventured into the recycling business and there are reportedly quite a few start-up enterprises queuing to enter the space. The challenge is that scrap yards will take time to build.

Will the crude oil price fluctuation impact the government push for electric vehicles?

In the Indian context, in spite of the significant drop in crude oil prices globally, the final price of fuel to the consumer has not changed at all with the Government hiking excise duty correspondingly to compensate for the drop.

While in the short term, the current CIVID-19 negative economic impacts will delay purchase of new vehicles per se, we believe there will continue to be a concerted effort by government and other stakeholders to drive EV growth in India over the medium to long term .

While the EV segment in the country remains nascent and relatively small compared to traditional ICE segments, EVs reported a 20% increase in sales in FY20 compared to FY19. The bulk volumes however are from e2Ws, with the incentives provided by the government favouring this category. Going forward, further growth is expected to come from the e-rickshaws and e-autos segment.

There have already been significant announcement in 2020 aimed at accelerated EV adoption. From a tax point of view, the GST council has already reduced this year rates from 12% to 5% for e-vehicles, and from 18% to 5% for EV chargers. Policy schemes like FAME II (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) have been enhanced to spur indigenous manufacturing and develop local technology by OEMS to make vehicles more affordable.

In the absence of government support what should industry do to revise the automotive demand?

The Indian automobile sector, was already undergoing a prolonged turbulent phase, experiencing a slowdown well before the virus outbreak in the country. Stringent environmental and safety regulations, moderating economic growth, growing shared mobility, increasing insurance norms, large inventories at dealerships and cautious lending by financers, were all key factors already attributing to declining vehicle sales in the country.

With social distancing unlikely to disappear in the foreseeable future, e-commerce will become an important buying channel for almost everything, including cars. Automakers and dealers need to develop online sales strategy appealing to their customers and consistent with their brand experience An online presence is a 'must have' feature, with customers choosing online as the first point of connecting with the brand.

Dealers are already enhancing their online selling capabilities and using inexpensive ways to communicate with car buyers, through Zoom calls and WhatsApp for instance. Initial industry feedback has been somewhat surprising, revealing an overall better buying experience compared to walkins. Dealers lacking online capabilities are now partnering with third party apps to connect and communicate with car buyers online. Growth of comparison and buying sites like Cars.com, Carvana and Vroom provide a wealth of information like availability, specifications, comparisons and video reviews to aid buying decisions. Price comparisons influence buying behaviour by helping consumers make informed decisions around costs.

Counterpoint Research also sees a rising trend over the next few years around health related features being requested by car buyers – especially amongst vulnerable older age groups, those spending considerable amounts of time in their cars, and drivers and passengers of shared mobility and other public transport options. Recent features developed by OEMs specifically for preventing the ingress of virus and bacterial contagions like COVID-19 include :

- A N95 certified Intelligent Air Purification System introduced by Geely Motors in China.
- Jaguar Land Rover is working on adding a special ultraviolet (UV-C) light sanitizing unit
- MG Motor has partnered with Singapore based Medklinn for cabin and surfaces sterilisation

Such recently introduced health features, along with other basic features, could prove to be a key differentiator and consideration for customers. Additional safeguards combatting bacteria and viruses could further improve brand image, conveying innovation, safety and customer centricity.

Moving forward, working in collaboration, through partnerships, alliances and joint ventures with stakeholders within the ecosystem will be the key strategic option to be considered by automakers looking to navigate the turbulent times ahead. ❑

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HOW TECHNOLOGIES USED IN AUTONOMOUS VEHICLES CAN MITIGATE THE COVID SITUATION

ARUN PRASAD & ASUTOSH MISHRA
TATA CONSULTANCY SERVICES

COVID-19, one of the worst pandemic to hit humanity in the last century, has changed the ways of our lives, disrupted Global Supply chains, put a grinding halt to many economies, and most importantly has led to tremendous loss of lives. It also exposed how underprepared our current systems are to handle a pandemic at this scale and every day the virus is claiming lives at an accelerating pace. There is no treatment protocol and until a vaccine is discovered and is successful in clinical trials and deemed fit for widespread commercial distribution, the primary way to combat the situation is through Mitigation and Prevention.

Tremendous effort has been put by researchers across the world to stop the pandemic through cutting edge medical research combining the use of AI in areas such as Drug Discovery, Diagnosis and Detection using Medical Imaging and using the Data Analytics for Contact Tracing to track and trace sick patients. While great minds are at work to solve the problem, frontline workers in hospitals and law enforcement agencies are risking their lives to control the pandemic to the extent possible, the least that we can do from our end is to ensure Social Distancing, wearing Protective Mask and Maintaining Hygiene.

Observing Social Distancing principles at Public places, wearing Personal Protective Masks, and following Hygiene through proper handwashing techniques can prevent the spread of the disease. It is easier said than done. Humans are after all a social animal and getting adjusted to this new norm may be counter intuitive to the very human nature. Enforcing these new norms is against human nature, adjusting to the new norm takes extraordinary commitment and Hawkeye monitoring. This where maybe technology can help us, to detect, monitor, and alert us if we are violating any of the prevention measures described above.

Autonomous Vehicle has a robust perception system that consists of multiple Cameras, Lidars, and HD Maps to make sense of the surrounding. One of the tasks that are routinely performed by Autonomous Vehicles is to Detect, Classify and Track objects such as Vehicles, Pedestrians, Lane markings, static and moving objects, traffic lights, and traffic signage. These tasks are done in real time

at an incredible speed and high accuracy and the Autonomous Vehicle achieves this feat by using Deep Learning Models that are trained on huge volumes of Dataset.

For these perception algorithms to work effectively, it needs to be trained with a steady influx of high quality annotated or labeled data which is done through a process known as "Data Annotation" which is essentially tagging and classifying objects in a given frame. The Data Annotation is done through various types of Annotations such as Classification and Localization using a 2D Bounding box, Semantic Segmentation, Instance Segmentation, or even 3D cuboids and Lidar Annotations.

We have been pondering how we can leverage this technology used in Autonomous Vehicle to mitigate the COVID situation. We observe that the cameras used in AV are somewhat analogous to what we find in CCTV cameras or a webcam (though what we use in Autonomous Vehicles are much robust and are of industrial grade) but at the core, it's a computer vision problem that we could solve leveraging the Data Annotation and Deep Learning. We propose 3 Proof of Concepts that can provide high impact to contain the spread of the virus and can be integrated into the existing infrastructure within a short timeframe.

1. SOCIAL DISTANCING VIOLATION DETECTOR:

Social Distancing is one of the most effective control mechanisms and is recommended by WHO, and other leading organizations at the forefront of the battle. The rules are simple, maintain a distance of at least 2m between you and the next person. Statistics say that if you do not follow the rule, a single person (without knowing being infected

WE CAN LEVERAGE THE TECHNOLOGIES USED FOR AUTONOMOUS DRIVING AND ADAPT IT TO CROSS-FUNCTIONAL AREAS SUCH AS SOCIAL DISTANCING, FACE MASK DETECTION, HAND WASH MONITORING

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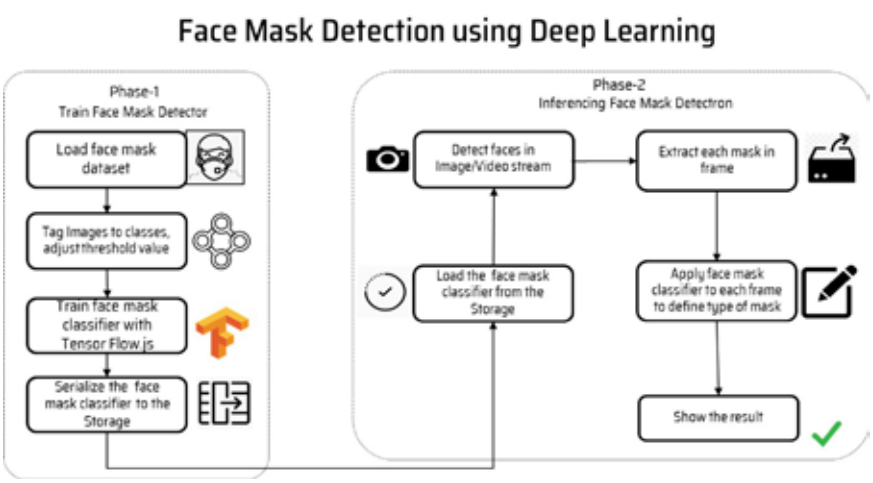


already) can spread to several hundreds of people. Social Distancing is hard to enforce, especially in a country with more than a hundred crore people. It could be a serious issue, that would require monitoring in addition to the commitment. Though the Commitment is on us, monitoring can be done by AI. Consider deploying a perception based deep learning algorithms on Surveillance drones, CCTV cams, that can scan an entire area and monitor any violation in real time and provide an alert in form of an alarm. This information can be used to calculate the Social Distancing Index and will help law enforcers strategize better.

2. FACE MASK DETECTION:

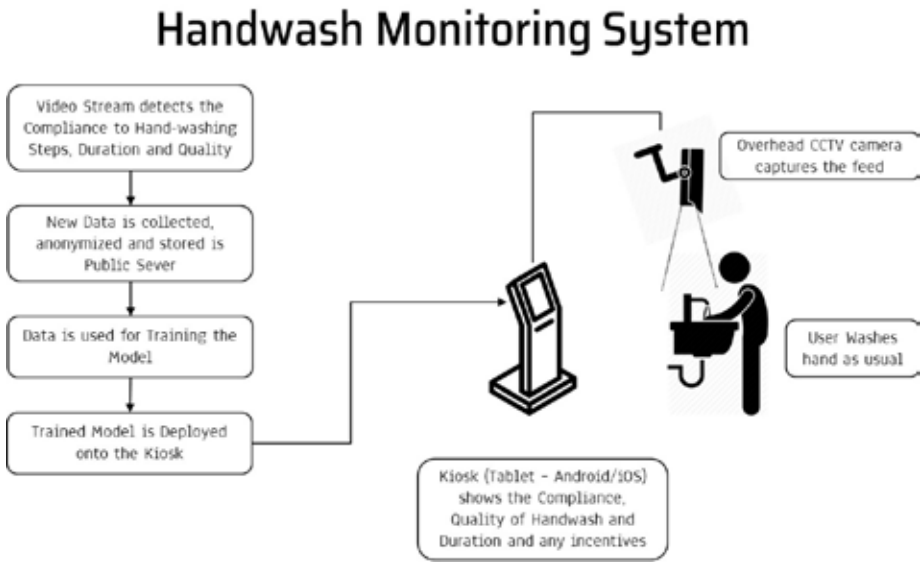
The next important norm is wearing protective Masks, which are primarily one of the most effective ways and easy ways of protecting ourselves from any aerosol based medium of viral infection. However, Masks come in various types such as Surgical Masks, N95 masks, Fashionable masks, and even a piece of cloth that is customized as a Mask. Given the size of coronavirus, N95 and Surgical masks provide a certain degree of protection while your cloth masks are as good as not having a mask at all and doesn't assure protection. But enforcing people to wear the right type of mask is a challenge. Consider, deploying perception based deep learning algorithms on surveillance drones and CCTVs, to monitor each and every face and alerts the relevant authorities of any violation, Even, deployed as a kiosk in Public or private workspaces to bar entry for violators.

3. HANDWASH MONITORING SYSTEM:

Yet another important norm is this dystopian world is our hygiene. One of the alarming reasons for such spread of the virus is the resilience of the virus in the external environment. Contact with fomites is also another major medium of viral infections. We tend to get contaminated in contact with fomites and touch our faces unknowingly and become infected. Hence, WHO recommends washing hands in soaps and alcohol based reagents in a seven step process to fully sanitize our hands after buying groceries, handling food, etc. Yet we do not follow. Interestingly, if incentivized, the adoption rate would increase dramatically. Consider, deploying a perception based deep learning model in public washrooms that can monitor the hand wash protocol and incentivize the person for doing it right.

CONCLUSION

As seen from the above 3 solutions, we can leverage the technologies used for Autonomous Driving and adapt it to cross functional areas such as Social Distancing Violation detection, Face mask Detection, and Hand Wash Monitoring. Today, AI is reliable, faster, and easy to build and deploy at scale. The system is an effective non contact fully automated solution to provide safer environments in places such as airports, hospitals, police departments, schools, businesses, and any large public gathering location. Several organizations, private and public, are in the race to build the AI techs to be sooner than later. Governments are encouraging development through hackathons, incubations, and incentives. With concerted efforts in all fronts, be it medical, behavioral or social through technology, we can hope to see a COVID free world in a few months, but until that time, as the old saying go, "Prevention is better than cure". ❑



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Ireland is emerging as a goto place for many of the technology companies like IBM, Microsoft, Facebook, Google, Intel etc. Telematics Wire had an opportunity discuss with Martin Shanahan and understand about IDA and how one can look for synergy with Indian ecosystem for technology development.

Could you tell us about yourself and some background on your journey to heading a government agency?

I have been the CEO IDA Ireland – (Industrial Development Agency) since 2014 and was previously Chief Executive of Forfás – Ireland's policy advisory board for enterprise, trade, science, technology and innovation. My interest has been varied as can be seen from my educational background. I am a masters of research in education degree from Lancaster University, a bachelor of science in management from Trinity College Dublin as well as a H.Dip. and M.Sc. from Dublin Institute of Technology.

I recently took on an additional role of Adjunct Full Professor at Smurfit Graduate School of Business at University College Dublin.

How would you like to define or introduce IDA Ireland to our readers.

I should begin by explaining my organisation, IDA Ireland. Our mandate is to attract Foreign Direct Investment (FDI) to Ireland and work with the companies to ensure that they are successful in Ireland. We are doing this for over 70 years and Ireland's performance as a hub for FDI is unrivalled. We work with the world's most innovative and sophisticated companies. Ireland attracts a much higher percentage of FDI than we might be expected to, given our size (about 2-3 times in fact if compared with our share of GDP). We have been very successful in the sectors we have targeted incl. Financial Services, Technology and Internet based companies; Biopharmaceuticals; Medical Devices, Manufacturing and Engineering including the Future Mobility sector. Ireland is one of the most globalised countries in the world. That openness has helped Ireland to attract investment, attract talent and to trade.

Ireland is home to many of the world's leading high performance companies like Intel, Valeo, IBM, Pfizer, Google, GM, Jaguar Land Rover, Citi, Infosys, Symantec amongst many others. IDA Ireland has played a vital role in the European investment journey of many large multinationals and other companies. My agency believes in nurturing high growth companies across sectors that are Ireland's strengths and helping them forge their future success in Ireland.

In the present geopolitical situation, every country wants to attract investment, especially in cutting edge technology development or related applications, how does IDA Ireland differentiate itself.

I completely agree that in today's era of global competition, technology is the differentiator, and therefore IDA Ireland places a focus on supporting technology intensive sectors and much emphasis is given on research and innovation. Ireland has an open economy that has outpaced many of its European neighbours in terms of GDP growth in recent years and has positioned itself as an epicentre for global trade. IDA's clients biggest export market is Europe (40%) followed by North America (20%) and the UK (12%).

There are many reasons companies choose Ireland as its location for investment and we have a world class value proposition. Ireland's openness to investment, business and international talent is a core strength and this will remain the case regardless of international developments. Different reasons attract companies to Ireland and that includes the ease of doing business in Ireland, with very low bureaucracy; our consistent pro enterprise policies including our corporate tax rate of 12.5 %; Ireland is the only English speaking country in the Eurozone post Brexit and one that follows the Common Law system same as India.

Ireland has a heritage in industry sectors such as electronics assembly and manufacturing, biopharma, medical device technologies, financial services and software development. Ireland has a strength in high value, highly regulated, zero defect manufacturing.

The key reason why major global multi nationals have chosen Ireland as their location to grow their technology development activity has been the availability of talent. This talent is drawn from across the EU and increasingly other markets including India.

Combined with the availability of talent, a strong ecosystem for research and innovation exists in Ireland. In line with EU State Aid rules, this can also be supported by R&D grants available to companies engaged in product and process R&D in addition to the 25% R&D tax credit available to companies.

As a final comment I can add that the rich pool of multinationals that have not just set up in Ireland but continue to grow their footprint are testament to Ireland's attractiveness for all companies large and small.

These factors place Ireland in a uniquely strong position vis a vis its other competitors.

There seems to be trend towards localisation with US nudging companies to have production in their own country, India doing the same. Comment.

In the last few years or so we have seen a rise in protectionism in many countries. Ireland is one of the most open globalised economies in the world and is a key part of sophisticated global supply chains.

Through the present Covid-19 pandemic crisis, Ireland's pro business ecosystem has supported the continued and seamless functioning of the international value chain. The stability and predictability of Ireland's approach to international trade and global value chains will further support MNCs in the forthcoming recovery period. The continuity of supply chains is a key focus for the Irish Government and for IDA Ireland.

We must be mindful that while countries may wish their indigenous companies to do everything in their home country, it may not be feasible to do so due to paucity of talent, expertise in a specific technology, economies of scale and most importantly an

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CEO
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ecosystem of collaborative companies and institutions. In case of India it has economies of scale when dealing with heavy materials and heavy industrial engineering. In fact, I believe there exists a great deal of potential for synergies between countries like India and Ireland, waiting to be created. This could be achieved through collaborations amongst academic institutions, cluster of companies, industry body and consortiums getting together, as well as working with my team and our sister agency, Enterprise Ireland, that helps Irish companies internationalise.

For Indian technology companies who are looking to move up the value chain by building products for the future, Ireland provides the perfect ecosystem to develop cost effective technology solutions from the ground up at world class institutes as well as a test bed to validate these systems.

How does investment in hi-tech R & D impact the overall economy of the country in long run?

I believe this works in two ways. Firstly, early investment in creating infrastructure and an industry relevant talent pool is required and that then has to be supported by creating the right ecosystem for companies to thrive and succeed, with the government supporting continuous training and research, development and innovation. The ecosystem will automatically develop and continue to flourish.

Over the seven decades of IDA Ireland's existence, we have worked with relevant government bodies to ensure the right skill set continues to be available in the market. This has been achieved through providing industry with a talent pool through investment in education as well as Ireland's traditional welcoming culture which attracts overseas talent.

Having identified the importance of future talent to serve the growth in cutting edge technology and engineering sector, the government proactively tuned its educational system towards industry. Today there exists a strong skills pipeline from the universities, Institutes of Technology and third level institutions. There are a large number of courses up to PhD level across technology areas including artificial intelligence, cyber security, cloud computing, as well as the conventional deep skills in electrical engineering and computer science. A recent example of this industry aligned education system includes online and taught courses in Connected & Autonomous Vehicles Technology, Blockchain Technology as well as Europe's first Master's course in Artificial Intelligence (AI)

Ireland also invested in research institutions and Centres of Excellence to support developments within the industry for sectors that Ireland has strengths in. Science Foundation Ireland (SFI), Ireland's national foundation for investment in scientific and engineering research, focused on supporting research talent, building a community of world leading researchers that are engaged in academic collaborations globally. SFI assists industry partnerships through various government funding schemes for collaborative research. Ireland today offers exceptional levels of collaboration between industry, academia, state agencies and regulatory authorities.

To share some research institutes that we have in the field of automotive and future mobility sector - Lero which specialises in adaptive and autonomous systems sensor technology; CONNECT specialising in 5G, IoT and smart sensors; TSSG focussing on V2X, IoT and safety of Autonomous Vehicles; Insight focussing on transportation and smart mobility; MCCI working on CAV network communications; ADAPT working on AI, image and video processing; Tyndall focussing on Antenna design and ICT.

Amongst the much talked about autonomous vehicle, industry 4.0 and others do you see any course correction arising out of Covid19 pandemic.

Undoubtedly the two largest megatrends we see impacting the global mobility market are Autonomous mobility and Industry 4.0. The continued evolution of these megatrends are disrupting markets and growing new alternative markets and business models, while continually evolving.

In Ireland there is focussed research to develop the next autonomous vehicle systems across many areas including autonomous luxury vehicles, tractors, container crane systems, intelligent vision systems and cutting edge chips and communications devices. Industry 4.0 and the developments in AI, fully electrified, autonomous and intelligent mobility will be the future. While work was being carried out in these areas, I see an immediate application of a number of these technologies, following the Covid-19 pandemic. The current pandemic has pushed companies to accelerate the development of the fully autonomous cars and technologies. The pandemic has pushed us to re think the application of the driverless autonomous cars to deliver packages instead of transporting people. As we speak, in some countries pods are being utilized to sterilize hospitals, deliver groceries, transport medical aids, and even deliver meals to isolation wards and individuals who tested positive for the virus. I see the application in dense urban centres, ports, and airports. I am proud to say a number of the systems are being developed, supported and built in Ireland.

Again, this pandemic has pushed companies to seriously consider Industry 4.0 and achieve automation and digitisation.

We understand that you are a champion for Diversity & Inclusion. How important is D&I to any company that is focused on the bottom line?

Firstly, Diversity & Inclusion is the 'Right Thing to Do'. Diversity of ideas aids better business decisions and results in better business outcomes; not to mention the happier and therefore more productive workforce. Companies also need to reflect societal norms which increasingly value diversity and inclusivity. The ethical case aside, there is more than anything, an irrefutable commercial case for real diversity. Bringing in people with different backgrounds and perspectives promotes innovation and creativity. Indeed, organisations with a diverse board see up to 53% higher return on equity and significantly higher earnings according to a McKinsey report. Research published by the Harvard Business Review shows that companies with greater diversity out innovate and out perform others. By correlating diversity in leadership with market outcomes as reported by respondents, the research found that employees at more diverse companies are 45% more likely to report that their firm's market share grew over the previous year and 70% more likely to report that the firm captured a new market. The findings are inescapable, diversity is a prerequisite for business success. ❑

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ALREADY CONNECTED THE CAR! WHAT'S NEXT?

KUNAL UPADHYAY
AIRLINQ INC.

Metamorphosis of the transportation ecosystem-

There is a major tectonic shift happening in the way OEM will offer its vehicles to consumers in the future. Most of the Automotive OEMs is already under transformation into major Mobility service providers, facilitating transportation services from point A to point B. Instead of buying cars from big brands, people would prefer to subscribe to mobility packages in a pay-as-you-go kind of model. The whole service offering will be on-demand in nature. It will be highly flexible depending on various parameters like the mode, time, purpose, passenger, and duration of transportation required.

The advent of autonomous electric vehicles drives further disruption-

Electric autonomous pods added to these fleets, along with Driverless revolution and all-electric mobility, will lower the cost per mile substantially, democratizing personal transportation access. Billions of people will spend an average of 2.5 hours per day in these autonomous, connected pods. The estimated revenues by delivering value-added services on top of this transportation network are nearly $1.5 Trillion by the year 2030.

The task at hand for Automotive OEMs?

- Rapid innovation in this fast-evolving business landscape
- Extend and futureproof Connectivity in all vehicles
- Build extensive Edge processing and analytics capabilities
- A clear roadmap to Autonomous and Electric models
- Integrate an Elastic layer of On-demand Mobility for users
- Service monetization on top of connected infrastructure

Time to check the current vehicular connectivity

Every OEM's connected car deployment is unique, so is their service vision. There are many standard connectivity solutions offered by telecom operators and intermediaries that are good to meet immediate needs.

However, to align with the significant shift visible on the horizon, OEM's need flexible software-defined connectivity. Along with a data pipe, it should also facilitate complex use cases around 5G, autonomous driving, edge computing, C-V2X enablement, vertical handover, regulatory compliances, multi-regional, and ownership changes as necessary. The success of a digital monetization ecosystem highly depends on the flexibility and robustness of underlying connectivity fabric.

Integration with monetization ecosystems should start now

The value creation models for connected automotive are highly dependent on building blocks - edge processing, vehicular data, in-vehicle HMI, and the cloud-enabled ecosystem of third-party service providers. There are hundreds of use cases to be developed on top of these blocks, ranging from:

- Revenue generation via tailored advertising, drive data sharing, dynamic insurance, in-car payments;
- Optimization using vehicle data, usage-based billing, on-demand services, driving simulations;
- Safety with warning alerts, V2X proximity alerts, maintenance alerts, advance road condition warnings;
- Autonomous vehicle (AV) where humongous real-world driving data is reshaping the AV accuracy and time to market;

These use cases validate the need to redefine the vision and mission around Connected cars. It further substantiates the need for developing a new value chain inside the OEM organization; to partner for expertise in software and apps, connectivity, data management, User Experience with strong play for AI, and ML.

Airlinq: Forefront of enabling automotive ecosystem

With a ubiquitous global fabric of connectivity, Airlinq acts as a glue between the Automotive OEMs and Telecom operators. Airlinq, having worked with leading global players to the likes of General Motors, Daimler Mercedes, Volvo & many more, understand the needs and has developed a tailored solution to align with next-generation applications around edge computing and ecosystem enablement.

Automotive OEMs eyeing seamless connectivity and global expansion of Connected business need a partner that can provide reliable connectivity & extend unified services across all regions of the world. With partnerships at Verizon, Docomo, Jio, Etisalat & many more, Airlinq stands at a unique position to offer single API based integrations for global roll-out. Automotive OEM gets the comfort of a single pane of operations with complete control over performance and revenues across the world. ❑

ABOUT THE AUTHOR

Kunal Upadhyay is Director of Sales at Airlinq Inc. An entrepreneur and driven techno sales leader who believes in software ability to solve complex challenges for enterprises and small & large businesses. He has extensive experience in Telecom and Automotive domains with focus on customer success by creating differentiated and disruptive software solutions in IoT & Connected Car technologies.

In previous roles he was co-founder at Teramatrix, (acquired by Airlinq – leading provider of Connected Car & IoT Solutions based out of Silicon Valley) leading product evangelism and sales function and collaborative product development.

SMART TECHNOLOGY WILL HELP STOP SPREADING CORONA VIRUS

TUSHAR BHAGAT
UFFIZIO INDIA SOFTWARE PVT LTD

With businesses across the world slowly starting to pace-up back to normalcy, a lot is uncertain and confusing. Pandemic has given us a great set back, but people and economy have to be back with their work and services for survival. But are we ready to live and work with a pandemic? We say these tough times demand a cuttingedge and scalable technology solution. A lot can be dealt, organized and followed by the means of technology. How? Hers what we are talking about.

PERSONAL TRACKER AND PROXIMITY SOLUTION

As an employer, let say, you run an enterprise of 100+ employees. To get back into operation, you will be required to abide by all possible safety measures. Now, you can't be every where keeping an eye on your associates whether they are following the precautionary measures strictly? Well, the good news is managing the health, safety and availability of your entire employees is now possible.

Few hardware companies and software companies have designed a personal tracker and a software which wears the hat of multiple functions. You can use this personal tracker as your employees' badge and effortlessly access the data in software regarding employee security. Let's get more into its details now.

HOW DOES THIS PERSONAL TRACKER WORK?

This is a revolutionary and scalable solution that tracks and records all the activities of your employee. An employee will be given the tracker to wear it around their neck as a badge that holds their ID card. This will be given to the employees at the start of their day at the office. They would press the log in button that would state their attendance. It can be also used to access the office rooms and halls.

The proximity meter of the tracker will constantly align with the other trackers checking and maintaining the safe distance from each other. In case of any violation in the social distancing, an alarm system will be alerted until the employees go back to a safe distance from each other. All the required information such as temperature test status, any dangerous contacts made, daily in and out time, etc can be easily taken from the tracker. With geofencing, five configurable buttons, no movement alert, man down alert and two way communication, this tracker will ensure complete safety of your employees. Above all, this device is extremely easy to charge, maintain and sanitize.

The economy can still boost and operate, only if ensure proper implementation of all the precautionary measures. We are glad to collaborate with Teltonika for being able to develop this revolutionary solution that will safeguard a healthy and safe working environment. ❑

ABOUT THE AUTHOR

TUSHAR BHAGAT
Director, Uffizio India Software Pvt Ltd

He has been in IT and software development for over two decades. He manages software development, sales& business development and also the finance. Before Uffizio, he worked at Eenergos Technologies, where he was handling clients such as L&T,Tata Power, Shoppers Stop and others.


PICTURE CREDIT | DOLGACHOV © 123RF.COM

The Shift in the Automotive Landscape by Merging of ECUs with Diverse Technologies

NARESH NEELAKANTAN
SASKEN TECHNOLOGIES LTD.

The Initial Age of ECU with Electric Vehicular Components

During the 1970s, the Automotive industry saw the introduction of radios and instrument clusters which were dubbed as 'meters' back then. Antennas to support their addition were also implemented, for drivers and passengers keen on seeking entertainment while on long drives. At that time, no one could have predicted the shifts in vehicular aspects such as design elements, ergonomics, and in vehicle real estate that occurred over the next 50 years. This move was also a cherry-on-top for the passengers and drivers; and they didn't complain about any reception or tuning issues. Automotive OEMs then started introducing features to ease the driving experience such as rotating headlamps, electronic power steering, automatic gearshifts, disk type brakes, intermittent wipers, and power windows. The impact of mechatronics as an added advantage for pure play mechanical system designs was clearly visible. OEMs and ECU manufacturers essentially monetized the benefits given to the customers. This covered not only services catering towards in vehicle entertainment and overall ergonomics, but also safety features which were absent in the conventional purely mechanical vehicles. OEMs and research agencies started thinking in terms of too many operational parameters for the drivers to consider while driving. This paved the way towards automating select vehicular electromechanical switches and operational systems.

The dawn of the 21st century saw the adoption of GPS satellites and essential services, initially restricted for the military, towards wider commercial usage in vehicles. With this, various new organizations rose as module makers and mapping providers. Telecommunication organizations also started entering this space, providing the first generation of telematics in vehicles. At this point of time around 20 years ago, the organizations' services focused only on location identification and the best routing options for vehicular navigation. ECU providers were using small, robust chipsets for specific embedded systems with limited processing, memory, and other sensory and control based functionalities. These units were placed next to the point of actuation of mechanical devices, based on specific electromechanical sensor inputs within the vehicles' real estate landscape. Nobody thought that these sensors and actuators would lead to formation of new organizations and businesses to help manage larger volumes in future. Antennas were also mounted with extensions, to leverage the maximum line of sight available for sending and receiving data via telecommunication and satellite infrastructure.

ECU Usage Pattern Shift during its Middle Age

The mix of hardware complexity and rise in ECU intelligence transformed mechanical designs into mechatronic alternatives with a powerful combination making vehicular systems robust, safe and secure. At the same time, electrical and electronic components within cars saw an exponential rise to support such ECUs. With the popularity of robust vehicles and the comfort they provided, the need for manufacturing such cars increased. Robotic assembly lines rose to the mantle with systems in place providing vehicle homologation along with the real estate landscape placements.

The rise in Advanced Driver Assistance Systems (ADAS) lead by cameras and ultrasonic sensors saw a spike in ECUs gaining more strength in terms of data, core, and memory pipelines. They enabled the sensors' intelligence and provided prompt response to avoid and mitigate accidents. This was supported by telematics based data to gain intelligence on the terrain being driven through and the necessary driving style required to maintain relative safe speeds. During their peak, ECUs, sensors, and actuators, had more than 200 units contributing to more than 200 million lines of code in a premium

segment vehicle. This was like compressing the highly populated cities in the world within a car's 1.9x4.7x1.7 meter3 real estate. The essential electronic, electrical, and mechanical components along with the sensors and actuators became densely populated. There was a need to free up space in the entire packaging and this began with the ECUs.

Current ECU Component Consolidation and Subsequent Complexities

In the last 4 years, several OEMs and Tier-1s realized that consumers including drivers and passengers appreciated ADAS and the additional safety, security, comfort and convenience provided by Autonomous, Connected and Electrification (ACE) technologies.

Connected cars not only provided infotainment and telematics applications as features, but also remotely updated themselves over-the-air. The mapping infrastructure was exposed to multiple low-earth-orbit satellites, and existing geostationary satellites, for consolidation enabling accurate positioning services. Maximum security was also provided for the telematics gateway to ensure only secure OTA updates were allowed within the vehicle. Consolidation of internal vehicle ECUs gained prominence in chips, with limited unauthorized access of critical vehicle infrastructure and actuators such as brakes and accelerations provided to the external telematics gateway. Exposure attacks for OTA updates were also a risk as seen with the Jeep Cherokee's vulnerability providing unauthorized access to the braking infrastructure.

> **"WITH ABOUT 200 ECUS/ SENSORS HAVING 200 MILLIONS OF CODE IN PREMIUM VEHICLE, IT WAS LIKE COMPRESSING HIGHLY POPULATED CITY WITHIN A CAR'S 1.9 X 4.7 X 1.7 M3 REAL ESTATE."**

Connected cars also gained prominence for supporting ADAS and Autonomous Driving capabilities. Sensors and actuators were replicated to act as fail safe modes as part of Functional Safety implementations. Along with sensors and actuators, ECUs also had a fail safe support system to make it foolproof against crashes as much as possible. Some of these algorithms were partially transferred to remote servers or Cloud computers to satisfy the limited calculation possible within vehicle ECUs, domain controllers or zone controllers. V2X was another addon gaining prominence both on the dedicated DSRC and on the C-V2X side, all of which increased complexity of the telematics gateway infrastructure. V2X provided beyond line-of-sight updates for maps, infrastructure and other critical road and vehicle density details. There were also multiple vulnerabilities being exposed, leading to strict vigilance of malware through Telematics Control Units. Massive data was throughput both in and out of the car; not only for entertainment but also for presenting critical infrastructure information in the telematics connections to the vehicle. Some amount of analytics was also being carried forward into the Cloud on such data.

The rise of electric vehicles and hybrids with the shift from conventional IC Engines led by government regulations and environmental groups resulted in necessary space reduction for the massive conventional engine. Depending on the model, some super sport cars and buses had rear or front end engine configurations. However, at the same time the full electric motors were placed next to the wheels, with the batteries on the chassis spread and grouped. They had additional switch over components, inverters, and battery management systems to name a few. The boot space on certain normal vehicles freed space for massive driving recording and other units to come in place. Some also provided boot space in the front for smaller baggage. At the same time, the cooling required for the batteries increased airflow inlets, filters, and coolants to go down around the battery layouts. Further with COVID-19's impact, OEMs are thinking of virus resistant filters into the HVAC components as add ons. Therefore, the filters and HVACs have additional components further increasing design complexities, along with those present in ECUs.

The Entry of Aggregation in Wireless Communications and Telematics Antennas

Around this time, another revolution was underway in the telematics ecosystem with massive wireless mediums all collaborating in the tiny vehicle real estate. The different wireless mediums in various domains like Bluetooth, WiFi, near infrared, radar, ultrasonic, V2X (DSRC/C-V2X), LTE/5G, and GPS/GNSS were all aggregating inside the vehicle. The shark fin antennas are also aggregating all possible combined wireless technologies into a single unit, adding to the accumulation of telematics antenna infrastructure.

The Automobile industry is constantly transforming itself by up scaling and providing the necessary comfort and convenience not only for high end vehicles, but also for medium and low end segments. This ecosystem will play a crucial role in the revolution of smart cities that will run parallel to advancements in vehicle ecosystems. ❑

ABOUT THE AUTHOR

Naresh Neelakantan is currently a Senior Architect for the Automotive Portfolio at Sasken Technologies Limited. With 15+ years of experience working with various Automotive companies, Naresh is enabling Sasken to navigate the next revolution in Automotive technologies. He is currently helping Sasken make strategic decisions in the areas of AUTOSAR and Autonomous Driving, while aligning the Automotive ECU-to-DCU market with Sasken's Chip-to-Cognition vision. He is an expert in Research & Technology Management of Embedded Software Architectures combining Analog sensors with Digital technologies and has successfully delivered more than 25 products (including microcontrollers, ECUs, BSPs, design models, architectures and applications). They have been implemented for over 1 million on-road vehicles around the globe and he has also participated in more than 20 Model Year programs.

SIMULATED WORLD FOR ADAS/ AD DEVELOPMENT, TESTING AND VALIDATION

MONICA SHRIVASTAV & **RADHIKA DESHPANDE**
EC.MOBILITY PVT LTD

The automotive sector is gearing up for a revolution. Just like the last century saw transition from bullock carts to automobiles, this century is about to witness a transition of a much greater level – the rise of autonomous vehicles. Path breaking technologies and algorithms have been introduced to tackle this challenge and move towards complete autonomy (Figure 1).

Safety is paramount when developing any vehicle, whether driven by a person or a computer. During the development of autonomous vehicles, the self driving technologies must be evaluated iteratively in a variety of driving conditions to ensure they are safer than human driven cars. For deep learning, there is a dire need for enormous amount of data. However, it is estimated that billions of miles must be driven before we can realize the dream of autonomous vehicles. But it is practically impossible to gather these billions of miles in such a short time frame given we are anticipating the revolution in the coming few years. What the world needs is intelligent system that delivers billions of miles with unparalleled cost & time efficiency.

Figure 1 Dimensions of ADAS/AD Development

Hence, simulated synthetic datasets are an ideal solution, enabling continuous, fast and unlimited data collection in the digital environment with relatively low operational costs. Self driving simulations have advantages in mileage data collection efficiency, road condition dataset diversity, and sensor data accuracy. The flexibility and versatility of simulation make it especially valuable.

In particular, simulation can be effective in testing dangerous or uncommon driving conditions. Without simulation, it would be far too dangerous to determine how self driving vehicles react to certain real scenarios – like a child darting out into the street from behind a parked car, or another vehicle running a red light.

Virtual simulations and synthetic data offer a faster time-to-market as simulations reduce the time required for physical prototyping and real time road testing. It is easier and more economical to test and improve an algorithm in simulation than using a car for live road testing. Being virtual, one can create unlimited amount of data with boundless variations and diversity while keeping low costs. The virtual environment simulation can be used for validation against requirements, sensor fidelity, platform performance, and environmental conditions.

FUNCTIONALITY AND USABILITY FOR ADAS/AD DEVELOPMENT

Virtual simulations and synthetic data generation are boost development of ADAS/AD -

Data Acquisition

Deep Learning or Neural Nets rely heavily on training sets which determine how accurate these models will predict and react to unknown scenarios. Synthetic data provides these training models with large amounts of balanced pre labelled dataset with sufficient diversity and accuracy - a dream-come-true for deep learning engineers. Photorealistic environments add to these advantages by filling the gap between real and virtual worlds.

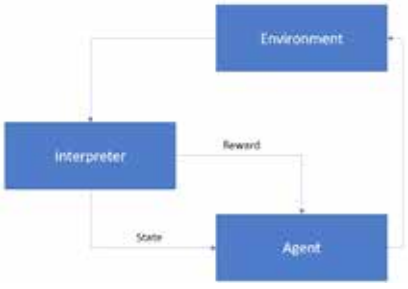

Figure 2 Reinforcement Learning (Source – Wikipedia https://Aen.wikipedia.org/wiki/Reinforcement_learning)

Algorithm Development

Virtual simulation set up allow for faster algorithm development. Model-in-loop and Software-in-loop techniques efficiently bring to surface bugs and logic errors, which would otherwise cause catastrophic implications and increase time-to-market due to physical testing. Reinforcement Learning, as shown in Figure 2, can be ideally visualized and implemented in the virtual set up, again paving the pathway for more realistic algorithms.

Sensor Simulation and Validation

ADAS/AD algorithms are undoubtedly dependent on sensor data. The performance of various sensors (lidars, radars, ultrasonic etc.) under different conditions can be very accurately predicted using high fidelity physics engines in simulations. The time consuming and costly field tests can be substituted with simulations which will provide vital information about sensor operation in real life before actually using it physically.

COMPONENTS OF SYNTHETIC DATA AND VIRTUAL SIMULATION TOOL

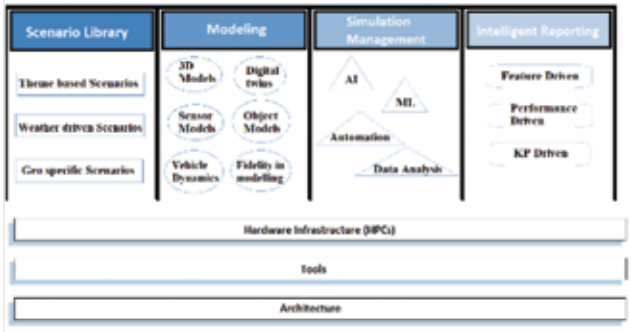

Figure 3 Subsystems for tool development

Figure 3 shows the sub systems of this tool. Each sub system is explained further.

Scenario and Environment Design

Scenarios are the first step towards creating real road environment in virtual conditions. This means building catalogues that have millions of scenarios. A library of scenarios is developed considering variations such as the road type, radiant, curvature, junctions, weather conditions, and other parameters. In addition to this, libraries of traffic signs, pedestrians, vehicles, buildings, vegetation, animals etc., need to be created while maintaining variety and diversity.

Modelling

To imitate and simulate real scenarios, an effective modelling of vehicle dynamics and sensors is of utmost importance. The environments and scenarios created should also be as close to real world as possible. While vehicle dynamic models have matured, the maturity of sensor models is evolving. Concepts like digital twins, procedural generation, object modelling, 3D modelling, etc. are being explored. They help in creating a virtual environment as close to the real world. The most important aspect of validation is how close one can make the virtual environment compared to the real world environment. Machine learning, artificial intelligence, Internet of Things (IoT), and many such technologies need to be integrated to provide a robust and efficient solution for simulation management.

Simulation Management

Scenario libraries and modeling provides the required virtual environment which replicates the real environment to the best of its abilities. However, to make use of this virtual environment, AI tools and simulation is essential. When we talk about AI tools, we are talking about ADAS/AD algorithms, software-in-loop, hardware-in-loop and data analytics. This will enable the user to generate synthetic data required for training as well as test and validate automation algorithms.

Intelligent Reporting

The final step in any process is evaluate that process both quantitatively and qualitatively. This can be done in the following ways:

1. Feature driven – When a particular feature is being evaluated
2. Performance driven – When an algorithm is being tested
3. KP driven – KPIs of the entire system are identified and analysed.

VISION FOR SYNTHETIC DATA AND VIRTUAL SIMULATION TOOL

While it already has unique products delivering key solutions for exponential ADAS/AD development, the company is geared up for completing the loop of products by launching its own tool for generation of synthetic data and virtual simulation & validation.

INTEGRATION

C.FRAME and C.LABEL are extensible tools developed by CMORE/EC.Mobility which are already competently providing solutions for data recording, data visualization and data labelling. The synthetic data tool will integrate the highly efficient framework of C.FRAME & C.LABEL with photorealistic virtual environment designer, seamless virtual simulation, sensor validation and effective testing to deliver a complete connected tool chain.

ARTIFICIAL INTELLIGENCE PRACTICE

The tool will increase productivity of AI practices by giving a higher learning curve, wider applications and a flexible platform. With high emphasis on Model-in-loop and Software-in-loop frameworks, the tool will provide a reliable testbed for ADAS/AD algorithms.

USER EXPERIENCE

The integration of highly productive tools and technology will allow user to drive towards full autonomy with a flexible framework and connected tool chain leading to faster ADAS/AD development. ❑

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NISHANT ARYA

EXECUTIVE DIRECTOR
JBM GROUP

The COVID-19 pandemic, the roller coaster ride of crude oil price over the last few months and there were questions amongst us about how all these would affect the electric vehicle segment in India. JBM Group has been an established manufacturer in electric bus segment in India and suitable to give leadership views on how the situation would unfold in coming months and year.

In discussion through email with Telematics Wire touches upon contemporary issues of automotive industry in India.

The Electric Vehicle is an Emerging Opportunity for India

What are your views about the road ahead for electric bus manufactured by JBM?

India is swiftly catching up in the e-mobility space, and given its potential, is all set to be largest EV market globally. Under FAME-II, the Indian government has outlined a spending of Rs.10,000 crore and Rs.1,000 crore has been earmarked for deployment of charging infrastructure from 2019 to 2022. The government's proposal to set up a National Mission on Transformative Mobility and Battery Storage to promote clean & connected technology shall provide impetus to a sustainable EV infrastructure in India. JBM is a one stop solution provider in the Electric Vehicle segment as we provide a complete ecosystem solution for E-mobility i.e. Electric Bus, Battery Technology, Charging Infrastructure based on the Operating Pattern within the city. In our endeavour to contribute towards a cleaner future, we have launched this ''Well to Wheel'' concept of e-mobility. Starting from energy generation to energy consumption, we provide end-to-end solutions. The first step in this direction was the launch of the 100% electric bus, ECOLIFE. ECO-LIFE, a Zero Emission Vehicle (ZEV). It saves the equivalent of around 1,000 tonnes of carbon dioxide and 350,000 litres of diesel over 10 years of its operations. This is a huge evolution from how public transportation operates in India.

The Indian auto industry has been preparing to align itself with the transition to BS VI and had aptly scheduled production and inventory to suit the given deadlines. Infact, India has been the fastest in transitioning to BSVI only in a period of 3 years. Auto OEMs have done a remarkable job in achieving a higher level of localization for vehicles than anticipated which is slated to enhance further in the near future. However, with the unforeseen slowdown of activity due to COVID19 thereby directly impacting the sales of vehicles, there still are unsold inventories lying with OEMs and dealers. Companies have approached the govt. to provide some relief in the form of deadline extension to see through such unsold inventory that will also result in reduction of losses at the dealers' end. The Supreme Court has given marginal relief in the form of few days extension post lockdown for sale of 10% of BS-IV unsold inventory, which needs to be extended further considering the volume of unsold BS-IV stock at hand i.e. 12,000 commercial vehicles, 15,000 passenger vehicles and over 7 lac 2 wheelers. On the other hand, post the lockdown phase, the offtake will be slow resulting in low sales due to the trapped liquidity and also, because the cost of vehicles will rise due to shift to BSVI. The performance of the auto sector in FY20 compared to FY19 has not been very promising in itself due to the already ongoing slowdown with commercial vehicles going down by 30%, passenger vehicles segment down by 18%, 3W down by 18% and 2W by 10% approximately. Now with the lockdown getting extended further, the pain points of the industry that has been reeling through bad times for more than one and a half year now, need to addressed by the govt. with much more solidarity. The volume of total sales in FY20 has been around 21 mln vehicles and FY 21 could witness going down further by 20-25% as a sector due to COVID wherein the maximum impact will be coming in H1FY21, whereas H2 will see some recovery happening. With this setback of sales by 20-25% the auto sector demand will go back by at least by 8-9 years in this FY21.

How will lockdown effect EV segment?

The Electric Vehicle segment is an emerging opportunity area for India. Having gone through the lockdown phase, people are now more focused towards their health, safety and environmental sustainability. The lockdown has had a positive impact on the environment and climate with air and water getting cleaner and fresher, which needs to be sustained. Thus, as responsible citizens and corporates, focus will be more on new technologies such as electric vehicles. Various govt. schemes that were announced in the recent past, such as the PMP, the Phased Manufacturing Programme will stand beneficial to promote localization by way of collaboration between the various EV and EV ecosystem players, thereby reducing the dependence on imports.

Will the current situation lead to reduction in R&D spend by JBM?

Further to our focus towards the electric vehicle segment and development of charging solutions &

technologies inhouse, JBM Auto had announced an investment plan to the magnitude of Rs. 500cr in a 3-year phase that started last year. The plan is well on track. As on date, Rs. 200 cr has already been invested in this business, the result of which has been our new product, the e9 ECOLIFE electric bus and the EV charging business that took off last year.

Will there be shift in buying pattern/ behaviour by the public transport companies?

India's 'one size fits all' approach may not work in the case of EVs. Products and solutions in the EV domain have to be consciously customized to suit the demands and usage patterns across various geographies or our country. I believe that the public transportation segment in India is best suited to embrace EVs at a much faster pace. Commercial vehicles, more importantly in public transportation, have been witnessing deployment of e-vehicles at a much preferred pace. The industry is working towards developing products that are not only 100% electric but also autonomous and connected. Pressing concerns like the depleting fossil fuels, global warming, vehicular pollution in metropolises, etc. have spurred many economies to look for more cost friendly and better alternatives to fuel the transportation of the future. JBM ECO-LIFE electric buses can run between 125-150 kms on a single charge, depending on the city's traffic conditions, which is an ideal range for intracity buses.

> **"MAKING THE ORGANISATION AGILE FOR SUCH TESTING TIMES HOLDS THE KEY TO SUSTAIN AND SAIL THROUGH THE CURRENT SITUATION."**

Do you think favourable policy can spur the growth in demand for automotive products? Will vehicle scrappage policy (yet to be announced) be a game changer in Indian context?

It is a given fact that the impact of COVID19 is going to have adverse effect on all businesses globally, but with the apt support from the government, resumption of activities can be smoother. In case of the auto sector which contributes more than 50% of national manufacturing GDP, the govt. needs to introduce special measures to bail the sector out of this phase. Countries such as Germany, USA, Japan, etc. have already announced steps such as tapping of insurance funds guaranteeing workers a minimum of 60% of their basic pay, income support for families of $1200 for adults and $500 for children, cash payout of $928 to all citizens, etc. We anticipate the Indian government come up with such measures as well. Like in 2008-09, the govt. had reduced excise duty in the auto sector, now it may introduce a reduction of GST from 28% to 18%. The months of April and May are going to fetch no revenues for OEMs, in such a scenario, the workers' salary may be paid out through various funds like ESIC for a brief period of time so as to deburden OEMs to some extent. For goods and raw material that has been already imported, eliminating demurrage charges for priority sector projects can be a viable step. Immediate relaxation by extension of the moratorium on interest payment and easing the burrowing norms and statutory payments can help us tide through the crisis. Taking a cue from global measures, subsidizing manpower cost with prime focus on blue collar jobs to aid workers can reduce the impact of downturn to some extent.

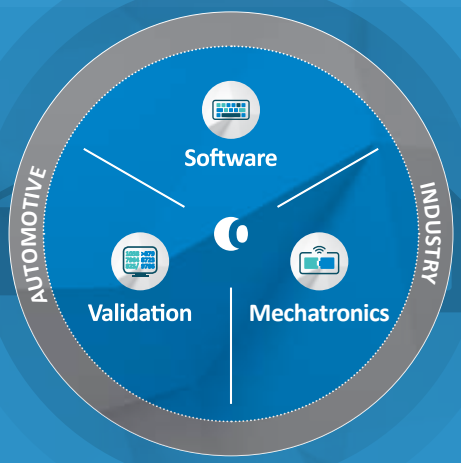
Any other point which you would like to highlight or share your views on.

The pandemic has hit the world severely, yet I believe that it will have a positive impact considering the bilateral ties between India and Japan, Korea, and the USA. Japan has already announced a $2billion investment package for companies to move out of China. The Make in India programme is sure to gain increased momentum with the inflow of foreign companies, thereby, strengthening the manufacturing capabilities inhouse and India well positioned in becoming the contract manufacturer for the world. The government can come up with new tax brackets to promote new companies to invest in India in sectors such as automobiles, textiles, high tech manufacturing, EVs, etc. The Electric Vehicle segment is another opportunity area for India. Having gone through the lockdown phase, people are now more focused on their health, safety, and environmental sustainability.

Learnings for companies from the pandemic?

Making the organization agile for such testing times holds the key to sustain and sail through the current situation. At JBM, we are moving very swiftly towards incorporating Artificial Intelligence and Machine Learning across our manufacturing facilities that will not only aid in a smoother resumption of operations post the lockdown, but also sustain a safe and healthy working environment for our employees. We are in regular touch with all our stakeholders to ensure seamless communication. The aim is to maximize and capitalize on JBM Group's inherent strengths and capabilities to minimize the impact of COVID on business, customers, suppliers, and our employees. ❑

EC.MOBILITY



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ANUJ AGARWAL
FOUNDER/DIRECTOR, AEROMOBIX SYSTEMS PVT LTD

What is X-by-wire

A technology known as X-by-wire and popularly known as Fly-by-wire in the aviation industry could redefine and radically change the way we drive in future. In a typical modern day vehicle equipped with a drive-by-wire system the driver does not have any "direct" control or mechanical link to the steering and braking system and will rely mainly on electronics to control a wide range of vehicle operations, including acceleration, braking and steering or gear shift . "By wire systems offer indirect control allowing for layers of safety and intelligence in between the driver and the vehicle". From modern day ADAS features such as ACC adaptive cruise control, LDW Lane detection & departure warning , AEB Autonomous electronic braking, self parking and collision avoidance to full autonomous driving is all made possible by drive-by-wire technology. Autonomous vehicles cannot move an inch without drive-by-wire technology.

Current challenges

Drive-by-wire systems are indispensable to any autonomous or smart future mobility platform. Connected vehicles exchange vital information and V2V, V2I and V2X technologies are racing to make a mark in future mobility but at some point this exchange of information needs to translate and render into vehicle

motion and be able to steer or brake the vehicle on its own , which is only possible by deployment of by wire technology. This in our opinion will empower the above & forthcoming technologies in the real sense.

However, Presently, there seems to be a lurking fear of physical "detachment" and letting go of the existing steering wheel or the brake pedals that provide a sense of "safety" to the driver over fully electronic systems which is quite natural. It is after all a habit and trust built over 100 years in automotive history. But with time as drive-by-wire systems prove its reliability and supersede mechanical drive systems with its clear and distinct advantages, this fear is bound to pass with time.

System reliability and redundancy. The Big question.

Redundancies tend to make any system more complex with added components , parallel systems and sub systems. As a system engineer we feel the safety and reliability does not entirely depend on system redundancy but the ability to detect or rather predict a probable failure and be able to bring any vehicle to a safe stop. If autonomous vehicles are to gain consumer confidence, they will have to be proven safe and must remain manoeuvrable even when navigation is interrupted or a subsystem fails. The challenges in development of safer systems lie in creating intelligent solutions for these indispensable redundancies at an acceptable cost. The redundancies can be created inside or outside the system. As we develop drive-by-wire steering and braking system we feel that that some systems and sub systems just cannot be allowed to fail and the bottom line is that we cannot have redundancy over everything. Hence our proprietary non redundant safety system (NRSS) is a highly intelligent solution to this problem and will most certainly send our competitors back to the drawing board !

Our Journey

Like everyone else, we picked our own battles foreseeing the immense future for SBW and BBW systems backed by our 15 years of R&D . Currently , The global drive-by-wire market is valued at USD 19.49 billion and is projected to grow at a CAGR of 8.86% during the forecast period and reach USD 34.63 billion by 2025 and then grow exponentially. Every car that we then see on the road will be equipped with a by-wire control system. Fewer components, modular design, improved reliability, intelligent & safety features make it a synonymous choice over conventional systems. ❑

Cyber Security

Ecosystem in the World of IoT & Shared Mobility

ANIKET KULKARNI
GRAB GROUP R&D

Different, heavy, and broader worlds are tightly affixed with each other, The IoT, Telecom, Cloud, BigData, the domain of shared mobility, & Cyber Security. In today's modern world where automobile manufacturing organizations have built-in IoT embedded devices, and a dedicated set of data is collected from a vehicle in real-time through that IoT device, transferred to Cloud via Telco, this sensitive data gets cloud computed, processed, analyzed, stored, and used for various business reasons.

Well, so even before we go further, what can these datasets look like? So it can be divided into two sections: A. Registered ***Drivers data*** (Name, Phone, Photo, Country-Identity Card, Driving Licenses, Email, and more..) B. Real-time ***Vehicle data*** (Geolocation, video, braking style, current speed, average speed, Engine on/off time, Engine idling time, Hard acceleration, Harsh braking, Sharp left/right Turns, Fuel consumption, Fuel levels, And more..) The sensitivity & importance of this data increases for a scattered business across the globe. And this data is collected say from various regions. Obviously, this will definitely be tagged as a BigData. Practically this data is owned by a specific business organization that is probably some automobile company. Applying appropriate data science and analytics, this particular case can generate us the combination of so many facts\patterns of drivers and vehicle usage. The number of business-sensitive problem statements can be predicted and solved in advance.

This case is pretty colorful now, we have personal data, as well as business-sensitive data. ***How if this data is stolen\breached through a Cyber Security attack and used by hackers?... If hacked\breached... can it be sold?.... Pheww....!*** The answer is simple, if not protected well, for sure, data will be breached, and based on its sensitivity, it can even get sold to the competitors. So let us have a quick dip into the cybersecurity ecosystem for a so far described connected world, and some primary areas to consider from the cybersecurity engineering controls which will make breach oriented conditions tuff to occur.

Securing Vehicle IoT Data Collection, hackers can extract and analyze electronic control unit (ECU) firmware. This allows for the discovery of possible vulnerabilities built into the firmware, as well as the extraction of sensitive data, such as encryption keys. This is the expected baseline assurance, to ensure that these files are protected and tamper-resistant is critical to overall system security.

Applying Cloud security covers the security of all the computing layers in public and private clouds. Apply tight security configurations for all cloud components\instances. Make sure we have appropriate EDR(Endpoint detection)\AMP(Antimalware protection) deployed across all instances. Better to have a brilliant vulnerability scanner running on all instances. Adopt golden image deployment with tight hardening, and automated patching capabilities. It is a must to have intelligent WAF (Web application Firewall) configured to protect applications, APIs, and mobile app backends against a variety of attacks including

the OWASP Top 10, zero-day threats, data leakage, and application-layer denial of service (DoS) attacks. Having advanced bot protection with machine learning capabilities will provide bot spam detection, credential stuffing prevention, request risk scoring, and client fingerprinting.

Applying Cloud Application Security covers the security of cloud applications, making sure the application layer is safe. This type of security consists of properly programming cloud applications to avoid vulnerabilities such as SQL injection, cross-site scripting, weak authentication and session management, cross-site request forgery, etc. Automated, secure-SDLC is implemented across the

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He is the security engineering leader at Grab group-Singapore, and a founder member of Grab's Infosec team. He is Heading\Directing bunch of Cybersecurity initiatives mainly inclined towards Cloud Application Security, Security Architecture, Regional data security and governance, Deals & Partnership Security focusing on southeast Asian countries giving legal, privacy angles for cross border data transfers.

> **"...DATA IF NOT PROTECTED, WILL BE BREACHED, AND BASED ON ITS SENSITIVITY, IT CAN EVEN GET SOLD TO COMPETITORS."**

Incident response SOC for shared mobility with Fraud\Abuse Cases Detection

We need to make sure here we have full-stack logs generated. Apart from regular cloud playbooks, with a special focus on defining mobility playbooks designed to block an attack targeted to a connected vehicle or mitigate potential risk. Mobility playbooks are completely different from enterprise playbooks where it usually involves assets like desktop, firewalls, etc. The mobility playbooks activate playbooks in the connected car's environment and include unique workflows such as putting a vehicle or group of vehicles on quarantine, updating the drivers/passengers, controlling the OTA servers, etc.

Identity is a very border topic, in this context it is all about controlling the organization's information in cloud applications by applying the right authentication & authorization mechanism. Well it should effectively control who is uploading\downloading files, what documents have sensitive information, what documents are exposed to the Internet, and several other aspects. A focal point to consider is considering the right solutions and the right protocols(OAuth, SAML, LDAP, OpenID, etc) for various assets\entities which this ecosystem with Identify all the way from an in-vehicle device to right data file is accessed by the end-user.

Well, the topic is going to be a never-ending story. Also, the views and opinions expressed in this article belong solely to me personally as an author and not my employer. Hence, by applying above cybersecurity pointers one can be in a decent position to at least make exploiting\breach oriented conditions to occur tuff. Let us park this as a Part-1 article covering, minimal cybersecurity considerations around these connected, & layered Ecosystem. Stay tuned for Part-2, which should focus on in-depth regional data security aspects, privacy, and legal angels….Stay tuned… ! ❑

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Reliability test for Automotive high speed In-Vehicle Network

DARSHAN MEHTA
TEKTRONIX

The move to advanced driver assistance systems (ADAS), connected car requires reliable in vehicle networking and high bandwidth connections. Cars can now contain complex embedded electronics connected to high speed sensors located around the car through multiple yards of cable harnesses. Traditional automotive networks such as CAN, CAN-FD, LIN, and FlexRay simply don't provide the necessary bandwidth to support all of the devices and applications found in modern cars. We have new high speed Automotive network standards adopted in car beyond 10Mbps like Automotive Ethernet.

Reliability is the most important aspect of Automotive design as some of the Electronics components are used for safety purpose. Electronics system in the case need to be tested across the entire design cycle of car. Also, just standalone component test is not enough. System level signal integrity test is very important to meet Reliability criteria.

In Vehicle Network plays very critical role here as it need to reliably transfer data from one node to other at harsh automotive environment (Noise, High Temperature and vibration). User need to perform Signal Integrity test at System level, scenario test like system performance test in presence of Electromagnetic or Gaussian noise, Protocol test etc. In this article we will learn about performing system level Signal Integrity test for High speed In Vehicle Network standards like Automotive Ethernet.

Automotive Ethernet

The need for greater performance and integration across vehicle subsystems is driving an industry wide move to Automotive Ethernet. Although the automotive standard has its origins in Ethernet, it incorporates significant changes at the physical layer to meet automotive requirements. The first version of the standard was known as BroadR Reach and is being supplanted by the IEEE versions known as 100BASE-T1 (802.3bw) and 1000BASE-T1 (802.3bp).

The standard being designed into most cars today is 100BASE-T1, which supports 100 Mbps operation in the very noisy automotive environment. This data rate is significantly faster than traditional bus systems such as the CAN bus. Future designs will use 1000BASE-T1, at 10X the data rate. As signaling moves to higher data rates, so too does the need for comprehensive design validation at the system level to ensure interoperability and reliable operation across the many ECUs and sensors; design considerations that were safely overlooked in the past now start to matter.

To achieve greater signal bandwidth, Automotive Ethernet uses a full duplex

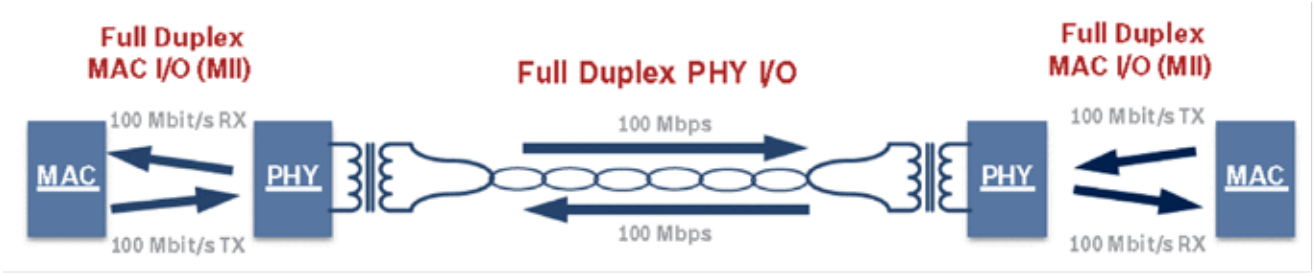

Figure 2. Automotive Ethernet allows Transmitter and Receiver to devices to communicate simultaneously over the same link.

communication link over a twisted pair cable with simultaneous transmit and receive capabilities with PAM3 signaling. Full duplex communication with PAM3 signaling can make visualization of Automotive Ethernet traffic and signal integrity testing very complex.

This article explores a new method for overcoming a key challenge when testing full duplex communications at the systems level, namely the need to cut the cables to gain access to full duplex signals.

Why system-level Signal Integrity and Protocol testing?

Test specifications for Automotive Ethernet have been defined by the OPEN Alliance for component, channel and interoperability, encompassing integration of ECUs, connectors and untwisted cables. In order to meet reliability requirements, testing must be performed under the noisy conditions found within the vehicle. This in turn requires the ability to characterize and visualize signal integrity and traffic at the system level under real world conditions.

Some examples for where you might want to perform signal integrity testing at the system level include:

- Open Alliance TC8 signal quality testing
- ECU component characterization and testing
- Automotive Ethernet cable, connector, cable length and routing characterization and testing
- Electromagnetic Susceptibility (EMS) test or Gaussian noise testing
- Automotive system impact on Automotive Ethernet performance
  - o DC motor on/off
  - o Engine on/off
- Automotive Ethernet Protocol Test

Ideally, you should perform signal integrity testing at the vehicle integration phase to select cables, check ECU performance under the electromagnetic noise condition, determine optimal cable lengths and routing, etc. For this type of analysis, an oscilloscope generated eye diagram is the most valuable tool for visualizing the health of the system and provides insight on the overall health of the physical layer (PHY) and can help identify errors due to higher temperatures or noise. Also, when using gateways that convert CAN or other traditional buses to Automotive Ethernet and vice versa, accurate timing measurements at the system level are critical for determining latency.

Full duplex test challenges

Full duplex communication along with PAM3 signaling, while vital to the performance of Automotive Ethernet, add complexity in validating ECUs under real world conditions. Most serial standards operate in a simplex mode with only one device communicating at a time, or there's a separate link for the transmitter and receiver. With Automotive Ethernet, however, the Transmitter and Receiver device communicate simultaneously over the same link. (See Figure 2.)

As a result, the signals from the Transmitter and Receiver are overlaid on each other. Figure 3 shows an example of an Automotive Ethernet signal without the separation of the Transmitter and Receiver signals.

As this example demonstrates, in order to perform signal integrity analysis over a link, and protocol decode in system environment on an oscilloscope, automobile designers need to look at each link separately, which requires separating the signals before performing analysis.

Separating Automotive Ethernet Full duplex signals

Currently, there are two methods for separating Transmitter and Receiver signals. The first is the legacy method that requires cutting the Automotive

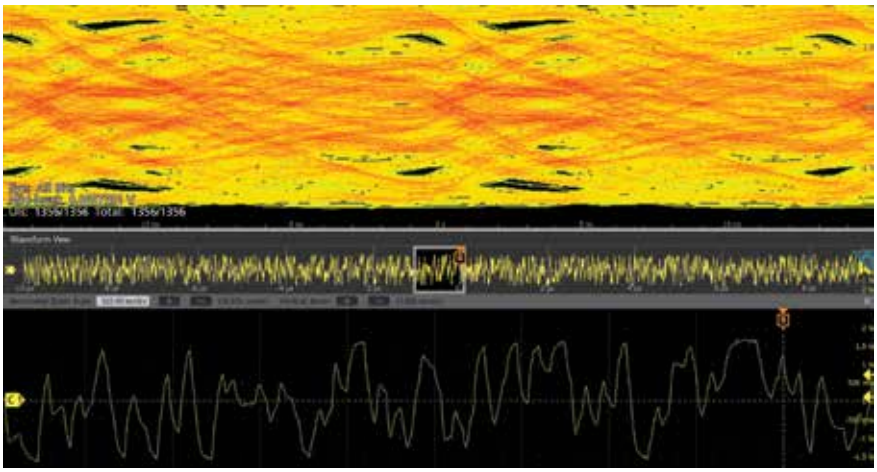

Figure 3. An Automotive Ethernet eye diagram is unusable without separation of the Transmitter and Receiver signals.

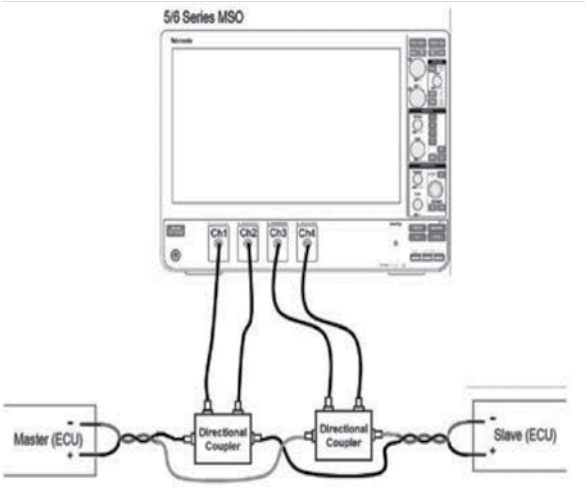

Fig 4: Directional Coupler approach for Signal Separation

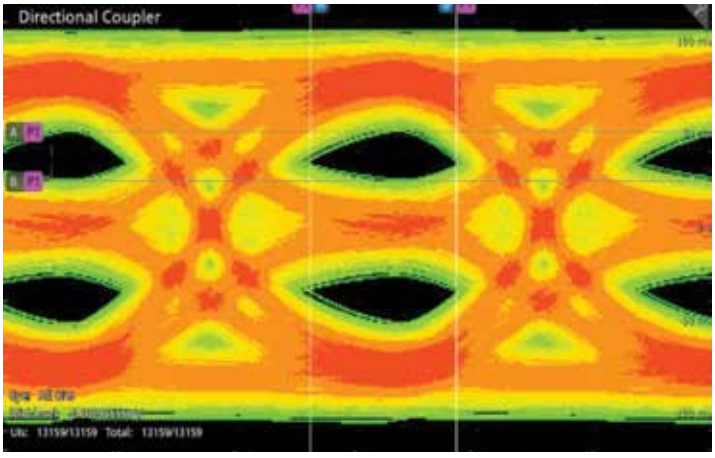

Figure 5. Eye diagram of a Transmitter signal illustrates the impact of insertion and return loss resulting from use of a directional coupler.

Ethernet cable and inserting a directional coupler to separate and test the signals. This method has inherent shortcomings for accurate testing with minimal disruptions.

- The directional coupler approach requires cutting the Automotive Ethernet cable and inserting a directional coupler to separate the traffic. It is not easy to cut the cable at the system level, which makes this method less than ideal for most system level testing applications.
- While this approach does provide access to the Transmitter and Receiver signals, it introduces Insertion and return loss, which can make it difficult to determine if an error is a result of the system or the additional hardware.
- And, while it is possible to remove the effects of the directional coupler, de-embedding can amplify the noise in the system and impact measurement and characterization accuracy.

The eye diagram we obtained in Figure 5 illustrates the impact of insertion and return loss on Automotive Ethernet signals with a directional coupler installed. As is visible, the max amplitude is just 100 mVpp while actual Automotive Ethernet signal is 2Vpp, as the directional coupler and the insertion and return loss close the eye diagram.

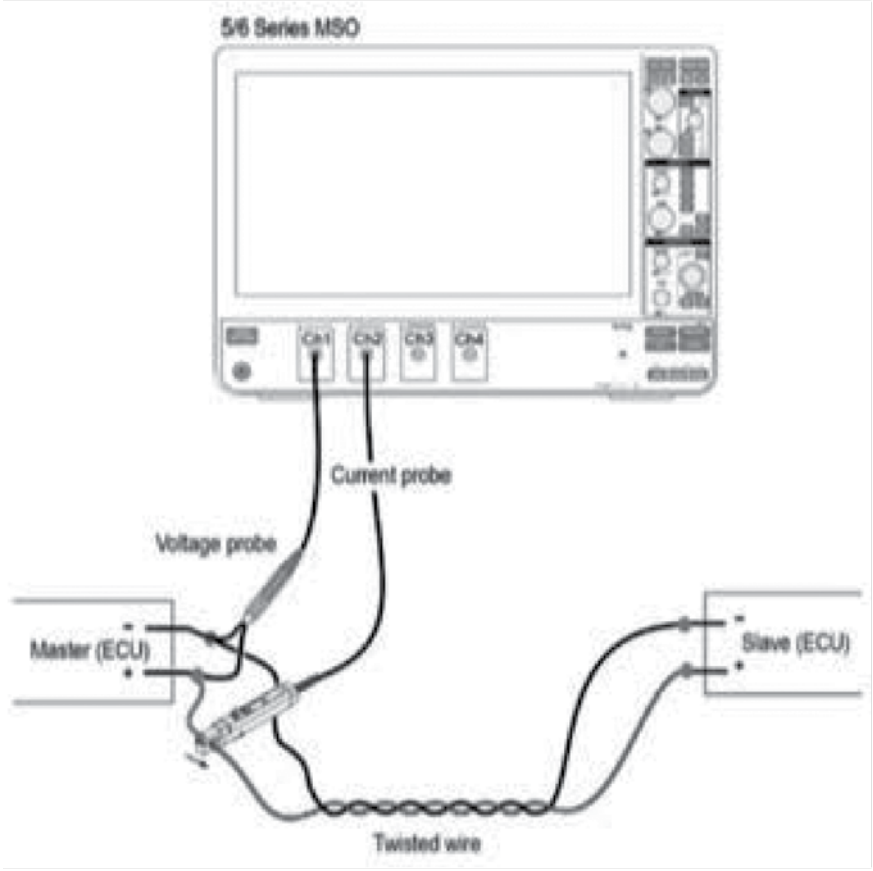

Figure 6. Using software to separate Automotive Ethernet signals reduces set-up complexity.

Software based Signal Separation method

More recently, test manufacturers have introduced a new methodology that uses software and probes to non intrusively separate the signals, allowing engineers to visualize the true signals with greater clarity. In contrast to the directional coupler which uses a hardware based approach to separate the signals, the software approach separates the full duplex signal by looking at voltage and current waveforms from both the Transmitter and Receiver test points and providing separated signals using software algorithms.

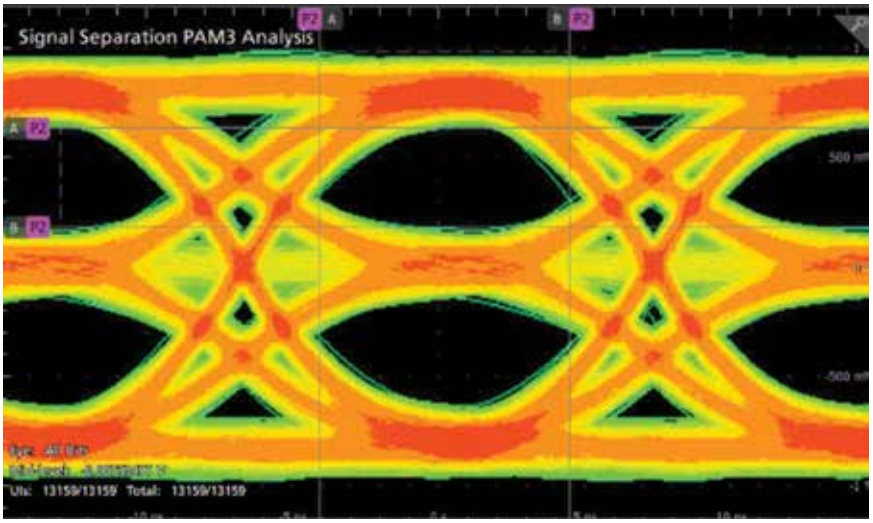

Figure 7. The use of a software-based approach to separate Automotive Ethernet signals results in "cleaner" eye diagrams compared to a directional coupler.

- Software based solution eliminates cutting the Automotive Ethernet cable and displays Transmitter and Receiver signals without adding insertion and return loss. And there is no need to worry about deembedding.
- Provides true signal to study signal integrity at system level

As shown in Figure 7, the software based approach improves signal quality with "cleaner" eyes. This provides a much more accurate representation of Automotive Ethernet signals for signal quality measurements and improves the ability to identify potential performance issues in less time and with greater confidence.

In comparison, the software based method as illustrated here shows the true signal without disrupting the system. This solution is available for 100BASET1 as well as 1000BASE-T1 along with user defined Equalizers configuration.

This new Automotive Ethernet test methodology will allow engineers to characterize signals faster and more accurately without cutting cable or adding new hardware. This method overcomes many of the challenges associated with performing Automotive Ethernet signal integrity tests at the system level and opens up a wide range of new use cases that were previously very challenging or inaccessible.

System Level Protocol Decode

Software based signal separation technique can be used for system level Protocol debug as well. This method provides accurate Protocol decode without cutting the cable.

Summary

System level signal integrity test is very critical for High speed Network standards to meet reliability criteria. Software based signal separation technique allows user to uncover signal integrity issues before integrating the entire system. This helps designers to perform "What if" analysis for Automotive Ethernet without impacting system performance.

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- https://www.tek.com/automotive/automotive-ethernet

Figure 8. Automotive Ethernet Protocol decode using signal separation technique.

ABOUT THE AUTHOR

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He has specialisation in automotive sector, having over 19 years' of experience in the test & measurement sector, essaying a multitude of roles in the automotive, mobile telecommunication, electronic & semiconductor industry. He has an insight into how modern test & measurement equipment can aid the engineers of today in creating the products of tomorrow.

AUGMENTING GNSS TECHNOLOGIES FOR V2X AND AUTOMATED DRIVING

ALEX NGI, U-BLOX

The best single-band GNSS receivers need ideal open-sky conditions to fulfil the accuracy requirements for V2X and automated driving. However, performance is lacking in urban and other challenging environments. A multi-band, RTK, dead-reckoning system using GNSS correction services and a dynamic vehicle model can overcome such limitations to reliably serve these use cases everywhere, all the time.

As the only technology capable of determining a car's absolute position in real time, satellite-based positioning is essential for vehicle-to-vehicle and vehicle-to-infrastructure (V2X) applications, Advanced Driver-Assistance Systems (ADAS), and automated driving. Being independent of maps and landmarks, and using operating principles unrelated to sensing technologies such as cameras, LIDAR, ultrasound, and others, it provides a platform and backbone for the multi-sensor networks needed to enable higher levels of driving automation including full self-driving vehicles.

Historically, the limitations of Global Navigation Satellite System (GNSS) receiver technology have tended to restrict navigation-system performance, particularly in challenging scenarios such as urban canyons and multi-level road structures. Today's receivers, however, are accurate to within just a few tens of centimeters and can achieve convergence time -- the time to reach a specified accuracy level after the signal is interrupted and reacquired -- of a just a few seconds. The typical latency -- the delay between making the position measurement and reporting the position to the network -- is approximately 10 milliseconds. Position updates can be delivered at well above 10Hz, and other technological enhancements have greatly improved positioning performance in urban environments.

In addition to improvements in GNSS receiver performance, semiconductor integration and Moore's Law scaling has condensed the main system circuitry into a miniature, low-power chip that is suitable for use in portable, mass-market devices. Moreover, GNSS correction services made possible by ubiquitous wireless Internet connectivity minimize the influence on GNSS accuracy of errors due to ionospheric effects. Finally, multiple navigation constellations are now in place, including GLONASS, Beidou, and Galileo, in addition to GPS, which makes additional satellites visible to each receiver and ultimately enables a superior user experience.

The combined effects of these improvements enable road vehicles equipped with the latest generation of multi-band, multi-constellation GNSS receivers to rely on positional accuracy within one meter and even down to a few tens of centimeters for some applications.

In addition to high positioning accuracy, low latency is also a pre-requisite for applications such as automated driving and V2X, which describes vehicles exchanging wireless messages with each other and with roadside infrastructure to share warnings, receive information, and negotiate priority at intersections or when merging or overtaking. In these situations, long latencies in positioning data can cause erratic braking or acceleration, leading to poor passenger comfort or lowering the efficiency of truck platoons. At worst, unacceptable latencies can cause collisions that may be serious or

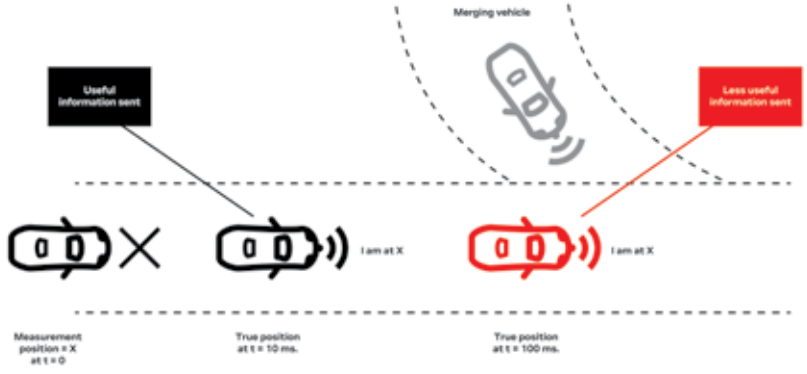

Figure 1: V2X use cases can be critically dependent on timely position data.

Application	Accuracy	Environment	RTK required	Multi-band required	Latency
V2X	<1m CEP50	Urban	No	yes	~10ms
ADAS levels 1-3	<20cm CEP50	Urban	Yes	yes	~10ms
ADAS levels 3-5	<20cm CEP50 + Protection level	Urban	Yes	yes	~10ms

Table 1: Known requirements for V2X and automated driving applications.

Note: All Applications require dead reckoning technology including wheel tick information. The CEP50 (circular error probability) value corresponds to the radius of the smallest circle that circumscribes 50 percent of all position measurements.

even fatal, for example at highway speeds where vehicles travel the length of a car in a tenth of a second. The ETSI (European Telecommunications Standards Institute) standard for V2X communication requires system-level latency of less than 100 milliseconds for most use cases.

Sensor fusion for fast convergence

Robust and continuous lane-accurate positioning, even in challenging environments, is a key requirement if forthcoming V2X communication and automated driving are to become acceptable in the marketplace and mandated by authorities seeking to improve road safety and manage environmental effects such as traffic congestion and avoidable vehicle emissions. When satellite signals are temporarily obstructed, they need to recover the high precision position solution in seconds. This can be achieved by combining various complementary elements in a single sensor-fusion filter as shown in figure 2.

Multi-constellation, multi-band GNSS receivers: With multiple GNSS constellations available, the inherent differences between the time differences of each constellation require receivers to "see" more satellites to unambiguously determine their position. When working with three constellations, roughly seven satellites are needed to compute the time differences whereas only four are needed to determine the position when using a single constellation. However, the greater number of satellites available more than compensates for this.

Additional unique capabilities of multi-band GNSS receivers include combining signals at different frequencies to eliminate specific errors. Techniques include simultaneously processing two signals from different frequencies to remove up to 99.9 percent of ionospheric error, and geometry-free combination for detecting cycle slips in the carrier phase.

Integrated Real Time Kinetic (RTK) algorithms: Standard-precision GNSS receivers trilaterate their position by tracking the code phase of GNSS signals from at least four GNSS satellites. High-precision receivers, on the other hand, track the high-frequency carrier phase and typically use Real Time Kinematic (RTK) algorithms to resolve carrier-phase ambiguities. These can be integrated in the GNSS receiver module and utilize correction data delivered over a wireless connection. In the automotive market this is typically cellular and satellite L-band based communications. L-band receivers not only benefit from lower data transmission costs but also can receive RTK correction in locations where cellular connections are poor or unavailable, such as in rural areas.

Broadcast GNSS correction services:By monitoring GNSS signals from a network of base stations, GNSS correction service providers can estimate signal errors continuously. One example is Precise Point Positioning (PPP)-RTK services, which compensate for satellite clock, orbit, signal bias, global ionosphere, and regional ionosphere and tropospheric effects. Ideally, corrections should be valid over large regions such as the continental United States and have minimal bandwidth requirements. Historically, these services have tended to send a tailored correction stream to individual users based on a rough position estimate. A more scalable approach is needed today, however, and modern service providers tend to broadcast the same dynamic GNSS error model to all users.

High-quality correction data not only increases GNSS receiver accuracy but also shortens the time for the receiver to converge to a precise position estimate.

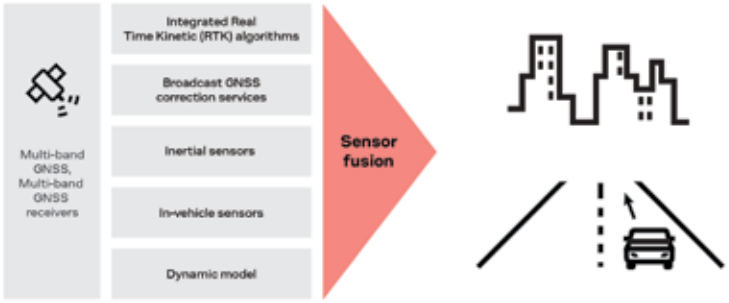

Figure 2: Leveraging sensor fusion for continuous, high-accuracy positioning.

This enables driving applications to overcome momentary interruptions to GNSS signals caused by obstructions such as overpasses, highway signage, trees, and bridges.

Inertial sensors and sensor fusion:Inertial sensors are commonly used to augment GNSS receivers by enabling vehicle positioning systems to rely on dead reckoning (DR) where GNSS signals are obstructed. Such environments are frequently encountered and include tunnels and parking garages. Fusing data gathered by the individual components of the Inertial Measurement Unit (IMU) not only enables the positioning module

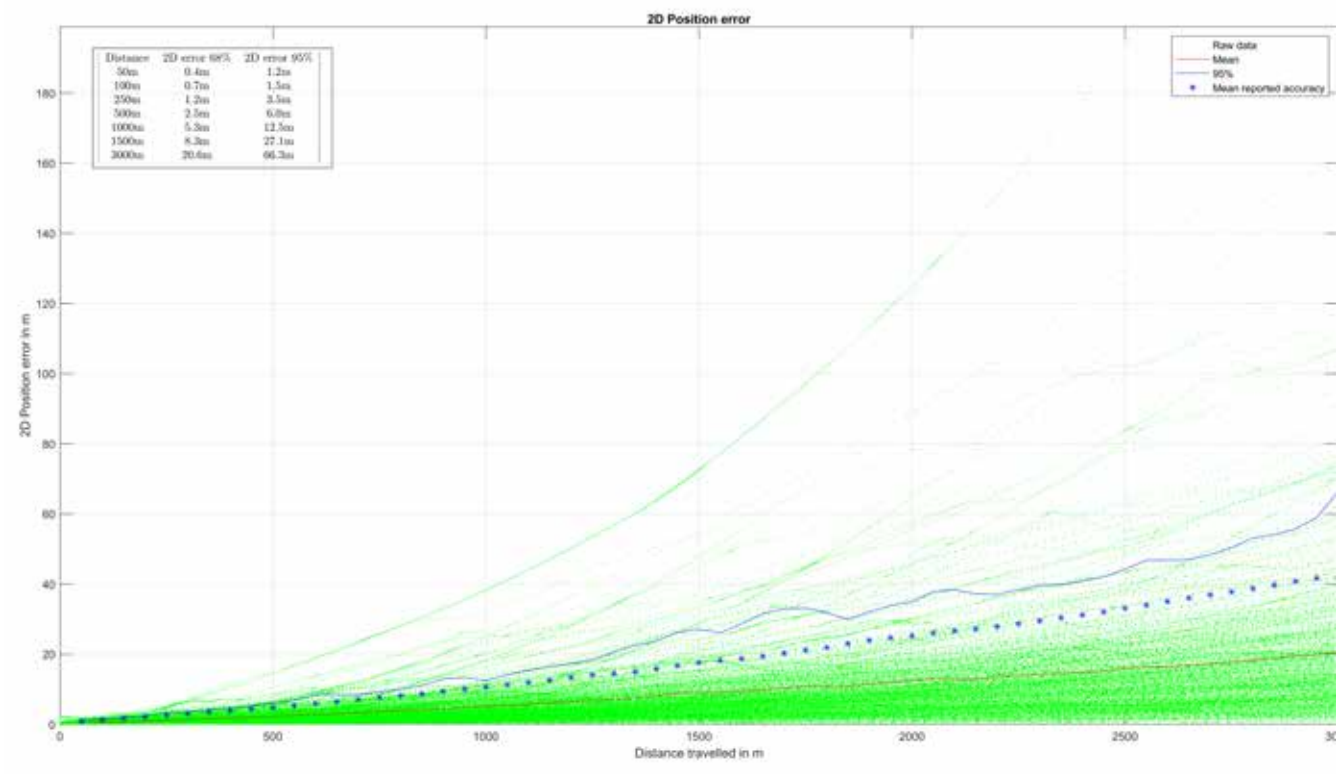

Figure 3: Position error in dead reckoning increases by about 20 meters per kilometer traveled.

to deliver position estimates where the GNSS signal cannot penetrate but also helps the system retain position and velocity information that can shorten the reconvergence time needed to solve carrier phase ambiguities when satellite signals become available again.

In-vehicle sensors:In-vehicle sensors such as the wheel-tick sensor can be used to further enhance dead-reckoning accuracy, while at the same time benefiting from continuous calibration based on GNSS velocity reading. Wheel-tick data provides a check on GNSS inaccuracies resulting from signal obstructions by enabling, for example, the system to reject incorrect GNSS position changes if the sensor indicates the wheel did not move. Combining the velocity reading and wheel tick sensor data is more accurate than integrating accelerometer measurements, which tend to be noisy. Continuously calibrating the sensor to determine the distance traveled per revolution enables the system to adjust for small pressure- or temperature-related changes in the wheel circumference.

Dynamic model:A dynamic vehicle model that incorporates assumptions about the vehicle's movements, such as knowing that it cannot jump vertically or accelerate or decelerate beyond predictable limits, enables the system to check the plausibility of GNSS measurements before using them in the navigation filter and so limit the effect of measurement errors on the reported position.

...IT IS POSSIBLE TO CREATE A POSITIONING SOLUTION THAT PROVIDES CONTINUOUS LANE-ACCURATE POSITIONING, EVEN IN THE MOST CHALLENGING ENVIRONMENTS.

Road testing the enhanced navigation system

u-blox has built an enhanced navigation system that contains a combination of these enhancement technologies - namely a multi-band, multi-constellation GNSS receiver with built in RTK algorithms, broadcast GNSS correction data, an IMU for dead reckoning, an external wheel-tick sensor, and a dynamic vehicle model. Several tests and simulations have been carried out to assess their combined effect on system performance.

Performance in tunnels

Quantifying the performance when driving in tunnels, which subjects the system to prolonged GNSS signal outage, is challenging. One reason is that accelerometer and gyroscope biases become the dominant sources of errors, which tend to accumulate as the signals are integrated to derive the velocity and the attitude respectively of the vehicle. Data needs to be collected from driving in a large enough number of tunnels to be statistically significant. Another is that there is no obvious "true" position with which to compare measurements. Ideally, an alternate positioning technology that leverages different operating principles needs to be used inside these tunnels to establish a reference that is unaffected by obstruction of the sky. Finally, even expensive inertial sensor-based reference systems exhibit a small but finite drift.

Before testing against a truth system in real tunnels, the road-test team created virtual tunnels by "unplugging" the GNSS receiver during open-sky conditions to simulate a GNSS outage forcing the system to navigate in dead-reckoning mode. This allowed a comparison between the performance of the inertial measurement unit (IMU) and a high-end truth setup. Logging the dead-reckoning results and readings from a high-end GNSS receiver used as a reference generated the data needed to emulate tunnels of different lengths on sampled portions of a given dataset. This enabled a creation of large enough set of test runs to be qualify performance in a way that is statistically significant.

Figure 3 shows the data from 1758 outages generated from 31 test runs. The results show that the positioning error is in dead-reckoning mode. On average, the horizontal positioning error grows by about 20 meters per kilometer, or approximately 2% over the distance traveled. The performance of the IMU strongly affects the tunnel test results, so it's worth noting that this test setup used an ordinary IMU with average performance and not a high-end device.

Lane-accurate positioning

Other tests were performed in scenarios of varying complexity to verify that the combination of technologies can provide reliable lane-accurate positioning. Because of the stochastic nature of GNSS and IMU errors, individual test runs can either over- or underperform compared to the results presented below.

The least challenging test case, comprising highway driving in mostly open-sky conditions, showed that the solution is capable of 100 percent availability and is accurate to within 5.8 centimeters 50 percent of the time. The horizontal velocity component was accurate to 0.02 km/h 68 percent of the time.

During the tests, the system was able to achieve the most accurate RTK positioning – namely Fixed RTK, where enough satellites are visible to resolve all carrier-phase ambiguities to an integer number of wavelengths resulting in the highest possible accuracy – for 82 percent of the time. The system relied on RTK Float results, when insufficient satellites are visible to fully resolve the ambiguities (resulting in reduced accuracy), for 14.8 percent, and used dead reckoning for 3.1 percent. The overall accuracy was found to be ten times better than existing single-band receiver technology.

Road testing in the center of Paris, including urban areas and highways, demonstrated significantly superior performance compared to single-band, non-RTK receivers. In the worst-case urban canyon scenario, encountered in the La Défense district, performance exceeded the minimum requirements for V2X applications. Even though the number of visible satellites was insufficient to allow full ambiguity resolution, CEP68 was about 1.1 meters and the accuracy was at least 1.70 meters for 95 percent of the time (Table 2).

Finally, testing in a two-kilometer tunnel in Gothenburg, Sweden, showed the system to perform better than simulations had suggested. Drift was only 1 percent of distance traveled and the system converged to lane-level accuracy within two seconds due to factors including multi-frequency GNSS receivers, GNSS correction services, and a relatively accurate estimate of the position inferred from dead reckoning. While it is understood that lane-accurate positioning cannot be maintained in long tunnels, highly automated and driverless vehicles can use alternative positioning technologies to restore accuracy.

Conclusion: on the road to greater safety, comfort, and efficiency

With the combination of technologies discussed in this article -- multi-band, multi-constellation GNSS receivers with built-in RTK algorithms, broadcast GNSS correction data, an IMU for dead reckoning, an external wheel-tick sensor, and a dynamic vehicle model -- it is possible to create a positioning solution that provides continuous lane-accurate positioning, even in the most challenging environments.

Road testing has shown accuracy to be ten times better than existing technology. Continuous service can be maintained in urban environments through a combination of multi-band, multi-constellation GNSS receivers capable of maximizing satellite visibility in partly obstructed scenarios, dead reckoning to bridge short gaps in GNSS reception, and GNSS correction services for fast reconvergence after short signal interruptions. Moreover, system performance can be further enhanced by introducing information from other vehicle sensors such as cameras and radars, such that GNSS technology augmented with dead reckoning is ready for advanced automotive applications that can contribute to greater safety, comfort, and efficiency. ❑

Scenario	Open Sky (highway drive in Burgundy)	Urban (Districts 12-16, Paris)	Urban canyon (La Defense, Paris)
CEP50 in meters	0.05	0.65	0.81
CEP68 in meters	0.07	0.85	1.11
CEP95 in meters	0.13	1.83	1.70

Table 2: Positioning accuracy in road-test scenarios.

ABOUT THE AUTHOR

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Alex Ngi is Product Manager for the ZED-F9K ADR module series and a member of the Product Strategy Team of the Product Center Positioning at u-blox.

Telematics & Data Driven Digital Transformation - Automotive

Automotive Industry has been going a massive transformation with the advent of Digital Technologies and Data Driven embracement. With advanced Telematics, it is possible to look at capturing real time and minute vehicle diagnostics that can give crucial insights about vehicle health.

The Digital Transformation emerging technologyelements of Machine Learning, AI and Decentralised ecosystems brings in a massive transformation in terms of new business models and possibilities like Shared Mobility, Autonomous Experience, Automated Service, Enhanced After Sales Service Attributes, Field Service Automation, all of which can help in creating engaging Customer Experiences. That can be further elaborated into aspects of determining crucial attributes in terms of Customer Behaviours, Buying Appetite, Design Choices, Model Preferences, Service history attributes, Vehicle Maintenance History and so on.

For Automotive Makers as well as Resellers, one more impactful arena would be to look at aspects of the Used Car Sales Segments. Usually from the current ecosystem that prevails, there isn't a mechanism that can essentially determine the TRUE PRICE of a used car. Essentially there can be avenues to determine the BEST PRICE of a used car. But essentially that doesn't typically make the BEST PRICE always the TRUE PRICE of a car. A car used or newly purchased, albeit becomes an Asset and trying to get to the TRUE PRICE of a used car segment can help in establishing transparency, faith, trust and a serious differentiator from competitions.

Especially in the Covid19 era, this can be something very useful, and by the use of IoT Telematics Data, combined with Machine Learning & AI, mapped to service history records and other intrinsic details, it is possible to compute the TRUE PRICE of a used car and store the information into a Non-Immutable ledger leveraging Blockchain. Vijay Gunti and Swapnendu Mukherjee from DIGIOTAI Solutions led the implementation for the World's First CarPass Solution.

Currently there is no transparency or a trust worthy solution that exists which could determine the true value of a used car. Under the circumstances people have to rely on Sales People, Middlemen or intermediary agents to sell a used car. In this model the end customer doesn't necessarily get the true price, also the car makers have to unnecessarily provide shares or a percentage to the digital mediatory agents there by further compromising on their already low profit margins in the used car segment.

Using the Car Pass Solution We can effectively eradicate all the intermediary agents by means of technology adoption through IoT Telematics merged with Machine learning, AI and Blockchain. This kind of solution effectively helps in improving the bottom line margins as well as establishing customers trust in terms of value for money against the asset purchased.

Car Pass solution was World's first data driven pilot which was successfully deployed with two major automobile manufacturers in Europe. The adoption of the solution helped the automakers to have over half a million worth of bottom line profit margins across their used car segment sales. The same solution can be easily deployed across automakers around the globe as well as car resellers with optimum benefits leveraging technology instead of relying on other intermediary or third party agents. ❑

ABOUT THE AUTHORS

SWAPNENDU MUKHERJEE &
VIJAY GUNTI
DIGIOTAI SOLUTIONS INC.

How ITES companies can supplement in responding to Global Emergencies, while leveraging IoT offerings like Vehicle Telematics & Wearable Smart Devices

IKRAM PATEL
CAPGEMINI INDIA

A pandemic outbreak of this magnitude has caught automotive companies and whole other industries off guard, with a wave of ripple effects tearing through their supply chains and business objectives.

For example, lets look at the automotive sector.

We see many automotive players who have come forward by shifting the focus of their operations and are enabling governments to overcome the shortages of critical supplies like ventilators, masks, medical equipment etc. Some of the example are stated below.

In response to a severe shortage of response equipment, SAIC-GM-Wuling Automobile (SGMW) announced it would produce face masks, which can help prevent the virus infection via respiration. SGMW worked with Guangxi Defu Technology, who is an interior parts supplier, to install mask production in Guangxi Province. There will be 14 new production lines for both medical masks and N95 facial masks with the planned volume of 1.7 million per day.

Similarly, Ford is working with 3M & GE to channelize its manufacturing operations to make respirators and ventilators...and so is Tesla. Tesla would start delivering Resmed, Philips and Medtronic ventilators to New York hospitals by leveraging its plant capabilities in Buffalo.

While automotive companies have stretched themselves to fight back this situation by manufacturing products in the nick of time, it is equally important that the logistics of these lifesaving equipment is closely monitored to ensure on time availability.

This is where IoT as a platform comes into picture and can be best implemented in Fleet management and tracking. The implementation of IoT in this business function sector has already brought in a huge development. Trucks nowadays are integrated with weight measurement, location tracking, and several other sensors.

The best mechanism in order to have an eagle's view on movement to transport is by leveraging the potential of vehicle telematics.

Some of the major ways in which vehicle tracking can help both business organisations and government authorities are:

1) In monitoring the location and status of Fleets & Containers carrying these essential equipment on real time basis
2) Weight and Volume tracking of the cargo, which can be further analysed to arrest shortages, as well as plan the allocation based on geographic priorities
3) In tracking traffic conditions, which can be a crucial input to plan prioritized routes for the fleets in accordance with Traffic authorities.
4) And last but highly important - the status of drivers. It becomes imperative for both business organisations and government authorities to ensure that the health and fitness levels of the human resources who play the most important role in end to end supply chains, should always be in a green zone. Just like telematics devices for the fleet, human wearable IoT devices, can help the authorities monitor the mental, physical and immunity parameters of the drivers of these fleet.

There are multiple product offerings in the market, each with its own marketing pitch, offerings, subscription plans etc. These products also come bundled with multi device scalable dashboards which keep the users updated with insights, based on predefined data crunching logics.

While these dashboards and quite insightful and engaging, they do not serve the purpose of giving a holistic view for both strategic and tactical planning…

…AND this is where an IT leader like Capgemini and its enabling capabilities like iBPF (Integrated Business Process Focus) step in and play a role of a Data Artist.

By creating a Business Focused Single view Canvas of Data driven insights, Capgemini enables a business entity to have a consolidated single window view to track end to end movement of goods as well as of those, who are moving the goods. Interesting isn't it? ❑

ABOUT THE AUTHOR

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Capgemini India

Known and seen in his network as "The Story Tailor", Ikram is Currently employed with Capgemini Technology Services India Limited, and leads a niche IT Enabling Lever known as iBPF (Integrated Business Process Focus). From the sector view point, Ikram is the sector lead and enabler for Automotive, Manufacturing and CPRDT domains.

INDO PACIFIC JOURNEY OF CONNECTED VEHICLE

NITIN KAMBLE
TATA TECHNOLOGIES

Beginning

The automotive industry has been pushed for distillation and for further enhance for many decades, with each automobile revelation and discovery providing new alternatives for vehicles to be rigged with. It has been three decades since the first establishment of software components in vehicles; since then may different services have started to build on new technologies, as a result by creating various architectures, platforms, applications, and programs. Fifteen years back, Building Telematics application was a difficult task. Imagine TCU (Telematics Control Unit) with GPS and GSM modules with SIM inserted into it was having no internet facility. It was a black and white era where we decided to send data packets using SMS with a frequency of 30 minutes. I still remember the smile on many fleet manager's faces when they were able to see their vehicle location on the web. This is how we kick-started our journey of connected cars, and then we just kept improving continuously.

ABOUT THE AUTHOR

NITIN KAMBLE
CoE Head – Emerging Technologies, CEIT Tata Technologies

Nitin Kamble is heading global center of excellence for Connected Vehicles and Telematics at Tata Technologies. He has worked with major automotive and manufacturing companies on Connected Vehicle, Electric Vehicle (EV), Digital Transformation, Customer Experience, Mobility, and industrial IoT solutions. Apart from professional life, he runs NGO called FEEL (Foundation to educate, empower, and liberate) in Pune for underprivileged.

Managing Feels for India's largest CV manufacturer

We knew that our experience in building a rigid telematics solution will pay off someday, new toll and technologies have started coming in to market, also as there was a race of mobile network providers in India. Sooner the internet started becoming cheaper over mobile and the android phone started gaining market. Vehicles are equipped with several types of connections, either internal or external. We have been decided to build a fleet management solution, with UDP as a communication protocol from the vehicle to the telematics server. UDP means to send and forget, so we had to implement acknowledgment back to the vehicle. Internet in TCU was so unpredicted and dead slow that sometimes it was sending data packets randomly, so we had to serialize them. We build a fleet management solution and enrolled it to all our customers across pan India. Every day there was a lesson to learn, JAVA listener was listening to each data packet and processing them based on priority defined for them. And it was failing every day for different reasons. You won't believe, we re-architecture our solution for 13 times, and final architecture is still working since 2012 and live for India's largest commercial vehicle manufacturer.

China story

When you have done something different and it is working for long into Indian conditions then there will be many buyers behind you. We already have started making our Connected Vehicle Platform largely involving many open source tools and technologies. An open-source gave stability and scalability to this platform and by 2015, electric vehicles started booming in China. It was a proud movement when we teamed up with a prominent electric vehicle manufacturer for an end to end implementation of a connected vehicle with two-way communication. When data is a gold mine, neither startup automotive manufacturer nor old school automotive OEM trust in readymade connectivity platform. So, you must build everything from scratch for your customers, that's the opportunity to learn and try many new things, like message queues, data pipes, NoSQL databases, security implementations. And when you do it, many similar customers knock your door.

Japan, Philippines, Thailand, Australia, and way beyond.

Any vehicle, any device, single platform – is the mantra wherein we bring dynamism in data payload regardless of vehicle, or device. This has given us a key to implement a connected car services solution in Japan, Philippines, Thailand, and Australia for a major Japanese PV manufacturer. The integration of the MNO solution into the platform is just icing on the cake.

Post COVID scenarios.

Now we are in the middle of COVID crisis, the automobile market in the west is halted. However, lifting of lockdown in China has given space to PV customer to go to the dealership and check for new vehicles as customers hold the fear about health by using public transport. New buys have started demanding in-car passenger health monitoring features into your connected vehicle. This journey will never stop, new challenges will be addressed and catered by innovations. ❑

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SHARJAH

SELF-DRIVING VEHICLE DISTRIBUTES PERSONAL PROTECTIVE EQUIPMENT

The Ministry of Health and Prevention (MoHAP), Sharjah, has announced in the 1st week of May'20 about its deployment of self-driving vehicle to distribute personal protective equipment including masks, gloves and sanitizers to residents and workers of a residential complexes.

The initiative, which was implemented in cooperation with the Sharjah's Family Health Promotion Center, and Huawei, comes as part of the ministry's efforts being made to contain the spread of coronavirus.

Dr. Amin Hussein Al Amiri, Assistant Under-Secretary for Public Health Policy and the Licensing Sector in MoHAP noted that the UAE is better positioned to capitalize on AI technologies in implementing government projects. It benefits from the conducive legislative environment, flexible laws and regulations.

SOUTH KOREA

BLOCKCHAIN BASED AUTONOMOUS VEHICLE PLATFORM

In a government-led project to create a trusted platform for the verification of autonomous vehicle using blockchain technology is being set up in Sejong, South Korea. Sejong is a special self-governing city and de facto administrative capital of South Korea. It is a planned city designated as a testbed for smart city solutions.

This project is being led by the Ministry of Science and ICT and the Korea Internet & Security Agency, a state internet technology watchdog. The project involves an association of technology companies including LG CNS, the information technology wing of LG Group, and Unmanned Solution, a domestic autonomous shuttle maker. The association will develop a blockchain-based decentralized identifier (DID) verification technology to prevent the illegal cloning of self-driving cars' identities as well as hacking.

Sejong's smart city platform can support autonomous driving, grid-based energy control, artificial intelligence (AI)-based disaster control and smart farming, all linked to a 5G network.

GATIK ADDS AUTONOMOUS BOX TRUCKS TO ITS 'MIDDLE MILE' GAME PLAN

Gatik, a startup working on autonomous vehicle for short haul logistics, has come up with autonomous fleet solutions for urban logistics. In July 2019, it launched a commercial service with Walmart to deliver online grocery orders. At first, Gatik used light commercial trucks and vans. It's box trucks range in size between 11 and 20-ft long, can deliver ambient, cold, and frozen goods. Each vehicle finished between 6 to 15 runs a day.

"Micro fulfilment or distribution centres are all the rage right now — that's basically the wave that we're riding," Gautam Narang said. "Companies are targeting warehouse automation for micro fulfilment centres. They're automating the warehouses, and we're automating the on-road logistics."

Gatik intends to pull the human safety driver out of the vehicle. It's an achievable goal, Narang added, because the company has concentrated on repeatable pre-determined routes and has introduced constraints that simplify the technical challenge. For instance, Gatik vehicles don't make multiple lane changes and only make right turns.

UK TO SETUP ULTRA RAPID CHARGING INFRASTRUCTURE BY 2030

The British Department of Transport (DfT) has set new targets for the development of ultra-rapid charging infrastructure for electric vehicles. The intended plan is construction of at least six high powered charger (HPC) sites along motorways by 2023.

By 2030 this number should go upto 2,500 HPCs (150-350 kW) with each site having at least six columns. The DfT goes even further and wants to expand the number of rapid charging points to about 6,000 by 2035. To achieve this target, the government says it wants to work closely with the operators of major service areas.

Although, the DfT has yet to publish details on actual funding measures in its now described 'Rapid Charging Fund'. It is part of a £500 million commitment for EV charging infrastructure declared as part of the new budget in March.

The DfT also refers to analysis the government has undertaken to assess the number of charge points required to meet future en-route charging needs when traveling prolonged distances. The department claims that currently, a driver is never more than 25 miles away from a rapid (50kW) charge point anywhere along England's major roads, with a total of 809 open-access rapid charge points, as of 1 January 2020. This figure excludes Tesla Superchargers. Including Tesla Superchargers, there are 792 rapid and 311 ultra-rapid devices along the strategic road network (SRN), claims the DfT.

UK: WORK BEGINS ON AUTONOMOUS VEHICLE TRIAL ROUTE

WMG, an academic department at University of Warwick has started work on creating autonomous vehicle testing routes. The first type of vehicle to be tested along the route will be connected vehicles. Vehicles which can talk to each other and warn of traffic, crashes, and other risks that other connected vehicles may have seen or been heading towards. On the Midlands Future Mobility route, the vehicle will not be driving themselves during the initial stages of research, initially, they will have a driver and at times a second person keeps eyes on how the vehicles are working.

The route comprises a framework such as smart CCTV, weather stations, communications units, and highly accurate GPS.

In the future, autonomous vehicles will be tested on the route, although, these will also be closely monitored by safety operators ready to take over instantly in the event of a problem. Phase one of the route includes the University of Warwick, Coventry ring road, roads in Meriden, Solihull, and central Birmingham around the Jewellery Quarter. At the end of this year the route will be extended to include rural and highway roads and span up to 350km.

ON-STREET POP-UP EV CHARGING HUB TRIAL PROVES A BIG SUCCESS FOR URBAN ELECTRIC

British electric vehicle (EV) charging startup Urban Electric Networks Ltd announced the results of the trial of the UEone prototype on-street pop-up charging hub for electric vehicles. Urban Electric pop-up charging hubs were developed specifically to solve the problem of 'at home' charging for the 43% of UK households who have to park their car on-street (8M cars and light goods vehicles across the UK). The hub is designed primarily for convenient overnight kerbside charging, when cars are parked for 12 hours or more in the street where people live.

The app-operated charge points deliver 7kW at each socket and

retract fully underground when not in use, minimising the impact on the urban environment.

BAIDU APOLLO TO BUILD A PILOT ZONE FOR CONNECTED VEHICLE

Baidu Apollo has signed an agreement with Guangzhou Development District to build a pilot zone for smart transportation. Baidu Apollo and local authorities will jointly build connected infrastructure along the road network, facilities for intelligent control and smart automobile connectivity along with smart parking.

Baidu Apollo has engaged Haylion Technologies and Tiamaes, as partners for this project. The smart transportation will be based on Baidu's "ACE (autonomous driving, connected road, and efficient mobility) Traffic Engine".

Apollo has developed platform for Smart Traffic Signals, which reduces wait time from 20-30% in peak hours. It used holographic perception and detection system to detect status of pedestrians and vehicle in each lane, and recognise performance of current traffic flow such as volumes, queue length, delays, etc. Through integration of vehicles' positioning data, trajectory data and other multi-source big data it is able to analyse and predict traffic conditions.

SHANGHAI TO INVEST US$38B ON INTELLIGENT INFRASTRUCTURE

Shanghai plans to invest at least 270 billion yuan (US$38.6 billion) in three years on intelligent infrastructure construction. By 2022, the city will have over 100 autonomous factories or production lines featuring the latest artificial intelligence applications; 150,000 enterprises on cloud; more 5G base stations offering wide coverage and download speeds up to 500 megabits per second; more Internet data centers supporting cloud and artificial intelligence applications; roads and spaces supporting driverless vehicle tests; an additional 100,000 charger poles for electric vehicles and 15,000 new smart lockers supporting online shopping and e-commerce, according to a three-year new infrastructure blueprint. The blueprint includes 48 projects with an expected investment of 270 billion yuan. Of the total, 60 billion yuan will come from the government.

CHINA'S 5G-ENABLED ROUTE FOR V2X AND AV TEST SITE

Baidu is going to construct route for the pilot application of the 5G-enabled vehicle-infrastructure cooperative system in Hefei, capital of Anhui province, a project under China's Strategies for Innovative Development of Smart Vehicles. The 20 square kilometre test region will be equipped with V2X (vehicle-to-infrastructure) communication technology using 5G networks. Baidu plans to build road infrastructure with embedded sensors, traffic signal control systems, as well as the infrastructure to support technologies such as edge computing and data sharing capabilities.

Earlier, Baidu had received RMB 52.8 million ($7.3 million) government contract to build an autonomous vehicle testing site within the Chinese municipality of Chongqing. Learnings from Chongqing's driving challenges will be used in Hefei.

CHINA INVESTS IN EV CHARGING INFRASTRUCTURE TO OFFSET CORONAVIRUS ECONOMIC DOWNTURN

According to the National Development and Reform Commission, between May'20 and the end of the year 2020, China will spend almost $1.5 billion to install 200,000 EV chargers throughout the country, 20,000 of which will be public chargers. It's all part of a plan to revive China's economy after the coronavirus shutdown with more infrastructure investment in EV charging, intercity transit systems, ultra high voltage electrical grids, and 5G technology.

A state-owned electric utility, State Grid Corp of China, will play a key role in the EV charging expansion. It says it will invest $383 million to install up to 78,000 chargers in 24 provinces and municipalities, including Beijing, Tianjin, Jiangsu province as well as Qinghai province in northwestern China. 18,000 will be for public use while 53,000 chargers will be located in residential areas.

HUAWEI SIGNS UP CARMAKERS FOR 5G ADOPTION IN CONNECTED VEHICLE IN CHINA

Huawei has formed an alliance with an initial batch of 18 companies to accelerate the commercial development of 5G-connected cars in the country.

The companies that have signed up are- FAW Group Corp, SAIC Motor Corp, Dongfeng Motor Corp, Chang'an Automobile (Group) Co, Beijing Automotive Industry Holding, Anhui Jianghuai Automobile Co, Nanjing Automobile (Group) Corp Chery Automobile, BYD, Great Wall Motors, Guangzhou Automobile and Zhengzhou Yutong.

A vehicle with Huawei's 5G module, the Baojun RC-6 from SAIC-GM-Wuling Automobile, was already commercially released in December 2019.

Earlier Huawei had released 5G vehicle module, the MH5000.

CHINA TO ENFORCE ELECTRIC VEHICLE SAFETY STANDARDS BY 2021

Thermal runaway in electric vehicles (EVs) is one of primary cause of fires. In 2020 2020, China issued three mandatory standards for the safety of electric vehicles and their batteries. These new standards set to be enforced from January 2021 for (1) EV battery (2) Electric Vehicle and (3) Electric Buses.

The battery regulations emphasize the improvement in battery system safety regarding thermal diffusion, external fire, mechanical shock, simulated collision, thermal and humidity cycling, external short circuit, overcharge, and over-temperature. This covers the main causes of thermal runaway or fires in batteries. In addition to these points, the thermal runaway of one cell should cause no fire or explosion in the cabin for at least 5 minutes, allowing for occupants to escape the vehicle. The battery system is required to notify the vehicle occupants of a thermal incident immediately.

FROST & SULLIVAN: IMPACT OF AUTONOMOUS CARS AND EVS ON TEST & MEASUREMENT MARKET

According to Frost & Sullivan, the global autonomous car and EV test and measurement market is estimated to generate revenues of $1.6 billion by 2025, up from $1.2 billion in 2019.

Out of four types of testing-- ADAS, EV, infotainment, and connected car-- ADAS is evaluated to have the highest growth, reaching $659.9 million by 2025. This expansion can be attributed to the number of electronic control units (ECUs) and domain control units (DCUs) that are incorporated into a vehicle to make it fully autonomous and reduce its production time.

"There is a significant degree of overlap between infotainment, ADAS, and vehicle-to-everything (V2X); this overlap will increase as vehicle autonomy continues to grow, which will require testing methodologies such as hardware-in-the-loop (HIL)," said Rohan Joy Thomas, Industrial Research Analyst at Frost & Sullivan.

FORD

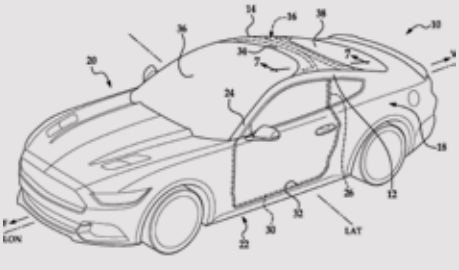
SELF-DRIVING DATA FOR ACADEMIC AND RESEARCH COMMUNITY

Ford is releasing data from multiple self-driving research vehicles collected over a span of one year to the academic and research community. This dataset includes not only LiDAR and camera sensor data, GPS and trajectory information, but also unique elements such as multi-vehicle data and 3D point cloud and ground reflectivity maps. A plug-in is also available that can easily visualize the data, which is offered in the popular ROS format.

The data set includes high-resolution time-stamped data from vehicles' four LiDAR and seven cameras, along with high-resolution 3D ground plane reflectivity maps. The dataset spans an entire year, and it includes seasonal variations and varied environments throughout Metro Detroit. It features data from sunny, cloudy and snowy days, not to mention freeways, tunnels, residential complexes and neighborhoods, airports and dense urban areas.

PATENT FOR INFLATABLE, SOLAR POWERED CHARGING CAR SHIELD

A Ford patent application which was filed on November 8, 2019, has been published on 14 May 2020, for a roof-mounted device that, with a flip of a switch, covers the entire parked vehicle in a shield of solar panels.



It's been more than six years since Ford introduced its C-Max Solar Energi Concept. In 2014, at CES, Ford showed the rooftop solar system that tracks the sun's movement and uses a Fresnel lens to concentrate its energy to charge the C-Max plug-in hybrid. The company claimed the system could produce 8 kilowatts of power.

Ford's new patent application describes the technical challenge: The problem is that the surface of a motor vehicle for fitting the solar cells is relatively restricted and therefore not sufficiently large.

Ford outlines in its new patent application, a rooftop-mounted shape-shifter: an "auto-covering fabric" with "flexible thin-lay solar cells" controlled by a "central shaft arranged on a rear bumper or in a luggage compartment." The cover is a "flexible shield" that gets unfolded via "an inflation pump," which is self-powered from the system's stored solar power. The shield's shape, when fully deployed, is maintained through "memory polymer." The driver activates the system with a "slider" so that the solar-power cocoon "can be switched between an extended and a stowed state."

Second opinion matters

Zen Microsystems is eminent in automotive testing industry across India. With a team of professionals and strategic partners, the company undertakes automotive testing projects complying global standards. Also, an authorised dealer for globally acclaimed high precision tools and solutions for automotive testing and standardisation. Zen Microsystems is one source window for professional automotive testing.

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CONNECTED VEHICLE JOURNEY IN INDIA

Connected Vehicle has evolved over the last two decades in India from providing a simple vehicle tracking in early 2000s to a portfolio of features which provides operational input data to several vertical industry segments. It helps in making the driving safer by making the driver alert of the possible threats and hazards. It warns the driver against the, over-speeding, lane changing etc. by sending alerts. Transport and fleet managers gets information about vehicle health besides its location. Connected Vehicle are now graduating to field application where vehicle will communicate with each other as well as with road furniture. Vehicles can do this and more are becoming reality of the day due to increasing set of sensors, ECUs, component platforms and more in vehicles. In India connected vehicle technology was believed to be limited only to vehicle tracking and navigation, but slowly the trend is changing. There are newer entrants in the connected vehicle segment in the Indian market also. As we progress and contributing towards the shaping the future of Telematics, companies are developing modular solutions for advanced telematics which will be capable of facilitating high communication bandwidth. This automotive solution is going to be industry's first 5G-ready with and multi-band conformal antenna to enable secure, fast and reliable data communications. 5G connectivity will also prove to be the major enabler in terms of the infrastructure to develop the Eco-system for connected mobility.

CONNECTED VEHICLE 2020

3, 4, 5 MARCH

ANALYTICS

1100+ PARTICIPANTS

80+ EXHIBITIONS

500+ VISITORS

10+ VEHICLE DISPLAY

20+ COUNTRIES

60+ SPEAKERS

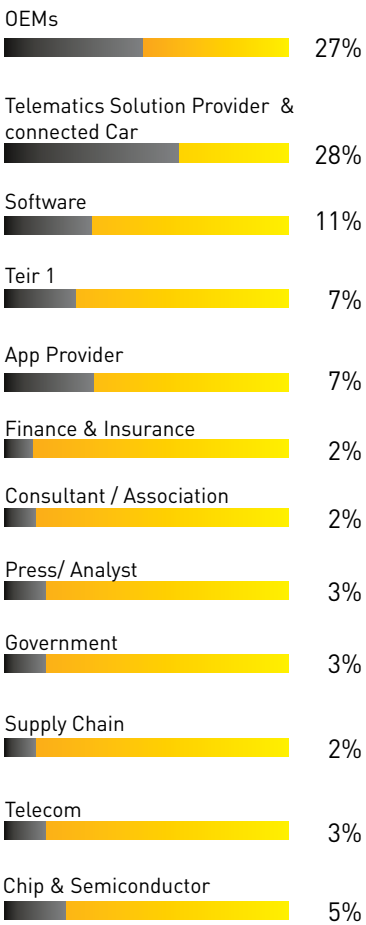
10+ SESSIONS & EXPERT PANEL

10+ KEYNOTES

20+ Countries

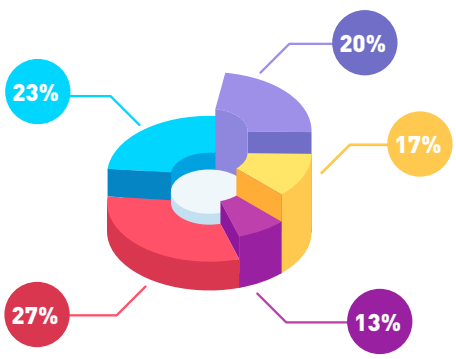
(India, USA, Canada, South Korea, Japan, Australia, UK, Spain, France, Singapore, Russia, Israel, Germany, Brazil, Israel, Italy, Switzerland, Thailand, United Arab Emirates, Sweden, Mexico, Sri Lanka, South Africa, Netherlands, Nepal)

INDUSTRY-WISE PARTICIPATION



PARTICIPANTS PROFILE

- CxO/MD/President/Country Head (Decision Maker)
- Director / VP/ Domain Head
- General Manager/DGM/ Manager (Sales/Marketing/ BD/Technology)
- Engineers/Subject Matter Experts
- Researchers & Consultants



THOUGHT LEADERS @CV2020

Thomas Fricke
Managing Director, Daimler Buses India

Four pillars that drive the change in bus and automotive industry are connected, autonomous, shared and electric. The future will see autonomous and electric vehicle with passengers using connected services. Technology is available; the question is when it will be implemented, what will be the sequence and what will be the path in India. In India use of electric propulsion buses will heavily depend on legislation on clean air and greenhouse gas reduction.The government support through implemented Fame is helping in research for electric vehicles but this is not generating a solution for series production of electric vehicle.

Vilasini Prabhu
Vice President Engineering, Electrical Electronic Systems, Renault Nissan

After selling the car we will leave our friend in the car called Artificial Intelligence, to learn and in-form. If there is any element which you can do sitting in the car, please do that. In India we need to provide V2X in our cars as early as possible, give better infrastructure facility. This is not much dependent on Internet and we need to plan our system accordingly.

Mahadevan Ramamurthy
Country Director, Ford Smart Mobility

Ford is evolving and expanding to become an automotive and mobility company using technology to help keep Indian cities moving. At Ford Mobility we're putting people at the heart of everything we do. Our "Office Ride" an app based shared mobility for corporate employees offers a more con-venient and productive commute. With over 1 million rides it helps remove 1,200 cars and bikes from Indian roads every single day. As part of a commitment towards seamless and shared ability while working which Chennai Metro we developed a dedicated technology platform that enables seamless first and last mile connectivity; and commuters can now find routes that connect to and from the nearest metro station, reserve a seat on a feeder vehicle and get real-time information about it.

Diego Graffi
CEO & MD, Piaggio Vehicles Private Limited

Connectivity has become a common word in our environment, which is meant to allow vehicles to communicate and exchange information with the world around them. It is not meant to take deci-sion on behalf of a driver, but put him or her in the condition to take the right decision at right time while driving the vehicle.

Mahesh Babu
Chief Executive Officer Mahindra Electric

There is a huge uprise in the thinking at policymakers, industry and consumer that there is a need for India to think about sustainability and sustainable mobility in the ecosystem. Physics says electric mobility is about four times efficient than IC engine. In India where we are looking at optimisation of energy utilisation, including LED lamps, it is important that we look at the energy needs of future mobility, which is clean. Moving a billion people cannot happen by car, it has to be a multimodal transport and our belief is that we need to get into multimodal rapid transport, where you get down from metro and use electric three wheeler, which too can be shared, to reach destination.

PANEL DISCUSSIONS

- Intelligent Connectivity: Opportunities, Challenges & Road Ahead
- Software Driven Innovation for ADAS & Autonomous Future
- M2M & IoT- Driving the Revolution of Connected Mobility in India
- Can Hackers Take Control of My Connected Vehicle?
- Telematics- Catalyzing Connected Vehicle Proliferation

TECHNICAL PAPER AWARDS

BEST 3 PAPERS

BUILDING CONNECTED VEHICLE PLATFORMS - A PRACTITIONER'S PERSPECTIVE

SURAJ NAIR
Senior Architect,
Infosys Engineering Services

VINOD VENKATESWARAN
Industry Principal
Infosys Engineering Services

SOA, NETWORK PROTOCOLS AND CONNECTED CAR FRAMEWORK FOR FUTURE VEHICLES

PRASHANTH RAM KURUMBUDEL
Senior Technical Architect
Elektrobit India Pvt. Ltd.

AUGMENTING GNSS TECHNOLOGIES FOR V2X AND AUTOMATED DRIVING

ALEX NGI
Product Manager,
Product Strategy for Dead Reckoning
u-blox

REMAINING TOP 7 PAPERS

The Block chain and autonomous driving coexistence

GOPAKUMAR NAIR, Line Manager, Elektrobit India

Case Study: Increase Assembly Line Efficiencies with the use of RTLS built over IoT

RIYAZ LAKHANI, CEO, QuicSolv Technologies Pvt. Ltd.

The importance of the digital assistant for achieving the vision of mobility

GERARDO GONZALEZ, VP, Sales, AirWire Technologies
RON FELICE, VP, Sales, AirWire Technologies

Camera based driver monitoring system using deep learning

NIRMAL KUMAR SANCHETI, AllGo Embedded Systems
MANJARI SRIKANT, AllGo Embedded Systems
KRUPA H GOPAL, AllGo Embedded Systems

Development of ADAS Bench for the Validation of ECU Functionalities by Hardware in Loop (HiL) Simulation

GOKULAKRISHNAN PANEER SELVAM, Senior System Engineer, BlueBinaries Engineering and Solutions Pvt Ltd.
ROHINI RAVICHANDRAN, System Engineer, BlueBinaries Engineering and Solutions Pvt Ltd.

Automatic Vehicle User Ambiance Controller and Child lifesaver

SILAMBUCHELVAN DURAISAMY, Technical Architect, Continental Automotive Components Pvt. Ltd.

Satellite free GPS mechansims for connected vehicle

CHANDRASHEKAR HS, Senior Technical Architect, Elektrobit India Pvt. Ltd.

EXHIBITION OUTLOOK

CV2020 hosted a large exhibition with more than 70 exhibitors working in the domain of connected and autonomous vehicle ecosystem across the globe. Along with display of vehicles, the exhibition showcased a wide range of innovations, products, solutions, services. Over the years, Connected Vehicle has emerged as a premier platform for the companies to exhibit their technological prowesses. It aims to show the industry's vision towards a safer, cleaner, connected, autonomous, shared and electric mobility for future. With an overwhelming response from both domestic and international market players, the exhibition has been a major success from the start.

SPECIAL TECHNOLOGY DEMONSTRATION

During CV2020 conference, there was a special interactive session with SecureThings's security researchers who won the Black Hat car hacking challenge in the past. They talked about various serious cyber threats to automotive ecosystem and demonstrated their deep research around Electric Vehicles. The reason why EV is very important for the industry to take note of is two folds; first discovered flaws are deeply rooted in how the EV architecture works, thus no matter what your implementation looks like you will carry the flaw by design; the second is the result of exploitation of these flaws is catastrophic leading to fatalities to human life.

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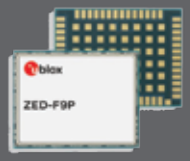
Highlights

Multi-band receiver delivers centimeter-level accuracy in seconds

- Concurrent reception of GPS, GLONASS, Galileo and BeiDou
- Multi-band RTK with fast convergence times and reliable performance
- High update rate for highly dynamic applications
- Centimeter accuracy in a small and energy efficient module
- Easy integration of RTK for fast time-to-market



Easy integration of RTK

Integrated RTK

- No third party SW integration on host required
- No resources (RAM, MIPS) required on host
- No license fee or NRE for the host SW

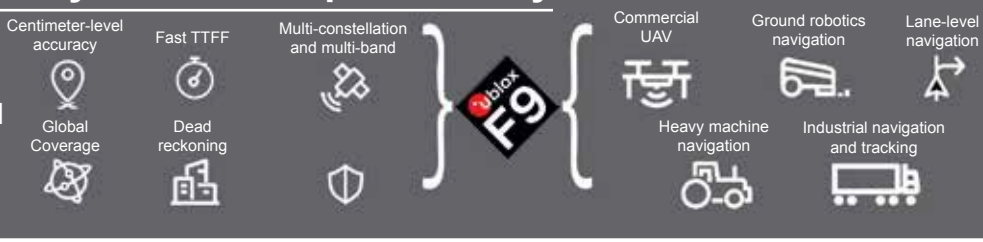
Multi-band in module

- Integrated HPG multi-band RF chain with guaranteed performance
- Little design effort, no design risk

- Quick to market
- No technology risk
- Low engineering cost
- Low capital investment
- Future proof
- Reduced supplier base

Navigation applications are demanding higher accuracy to increase productivity

- With high availability
- In all environments
- At sensible cost level
- Easy to integrate
- Globally deployable



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