CHANGING VEHICLE LANDSCAPE – "HELLO FUTURE!"

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"HELLO FUTURE!"

Over the past few decades, we have seen drastic evolution of technology from the humble calculator to modern mobile phones, more capable and advanced then the Apollo 11 moon landing shuttle. Just like time which stops for nobody, technology has continuously advanced. We can now cook our food in minutes using a microwave or shop for our favourite dress, without worrying about parking at the shopping centre or even leaving our home.

This is just like what's happened in the 20th century, where the flip from horse-drawn carriage to 'horseless' carriages has emerged within a period of 18 years.

Today in the 21st century, our motor-vehicles of this period have emerged from the traditional internal combustion engine (ICE) to other drivetrain technologies and are being established as viable alternatives, such as hybrid and electric fuel cells.



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Easter morning, 1900





42nd Street, 11 Jan, 2018

Established automakers and new venture startups are contributing towards this advancement in technology, from various in-vehicle active safety technologies to personal customisable features. Some governments are starting to mandate these technologies in the vehicles or outlaw traditional ICE from their city centres.

Semi-automated in-vehicle driving technology can now protect us from fatal and serious crashes in previously unimaginable ways.

Here's a taste of what we can expect in coming years:

POWER TO THE ELEMENTS

As Australian vehicles transition towards Zero Emission Vehicles (ZEVs) such as the electric vehicle, hydrogen vehicle and hybrids derivative, it is important to note Australia currently has 19.5 million registered vehicles [ABS, 2019] with an average age of 10.2 years. With annual sales of about 1 million vehicle units with only ZEVs contributing about less than 1% of new vehicle sales, it will be at least a decade or two before ZEVs becomes mainstream vehicles. However, as they become more accessible and cost effective, it will benefit us with increased safety features.

It has been suggested that by 2040, nearly 60% of all passenger car sales globally will be of ZEVs [IEA, 2019].



Image from The New York Times [The New York Times, 2020]

RANGE ANXIETY FOR EVS

The fear that electric vehicles (EVs) may run out of battery midway during a trip discourages people from adopting the technology. This is understandable if we consider the case of the mobile phone, laptop or electric bike. EV road charging seems a viable solution, enabling EVs to power up on the move.

The EV-charging road can be achieved through four components: copper coils under the road in the middle of traffic lanes, a receiver placed under the vehicle chassis, power units that transmit electricity from the grid to coils, and a system managing billing and charging.

Demonstration projects have been launched in Sweden and Israel. Once proven to be feasible technologically and economically, it could be a promising path to our zero-emission future.

In an article by Stuff magazine (March 2015), it suggested that Formula-E will play an important role in the acceptance of EVs as an alternative drivetrain, just like how Formula 1 technologies have trickled down to everyday vehicles over time.

At the recent International Driverless Vehicle Summit in Sydney [Nov 2019], Monash University via its motorsport team showcased its self-driving electric race car around a makeshift circuit. Will it only be a few more years until this "race" begins?





"CLOUD", "FOG", WHAT'S THIS?

Many automakers are starting to implement connected technology globally, and Australia as a recipient of imported vehicles will soon have these technologies fitted. This would allow automated updates of maps, calibrations, notification to owners/drivers and other live updates. Of particular interest in the technology is to identify issues with road networks, congestion or accidents in real time and allow other vehicles within approximate distances to be aware of the hazards and possibly avoid the area. It allows a vehicle to communicate to infrastructure and other vehicles. That technology is already here and utilised in other regions globally.

The difference between "Fog" and "Cloud" is the location of where information is stored, and the algorithms utilised for computing the situation.

Cloud		\mathcal{C}
Fog		
Devices	0 0	
ntegration		0
	System Latency	Data Security

C-V2X MAKES ROADS SAFER

C-V2X is a vehicle-to-everything technology particularly based on the cellular network. It is seen as one of connected vehicles' solutions, enabling smooth communications between vehicles, road infrastructure and vulnerable road users. Low latency and high reliability of communication are crucial in the context of road traffic.

In a recent field trial in Australia, a connected vehicle system was created upon Telstra's 4G network, Ericsson's C-V2X platform, and two Lexus RX 450h SUVs. The SUVs used the C-V2X platform to connect to each other, to traffic management centres with cloud servers, and to the Victorian Department of Transport's real-time traffic data. In 95% of the trial, the end-to-end latency was consistently under 50ms - near real-time. Various use cases were successfully tested, including slow/ stopped vehicle warning, in-vehicle speed advisory, red light violation warning, emergency electronic brake light, and right turn assist/pedestrian warning.

The success of this trial demonstrates the great potential of C-V2X in the 4G network and its greater benefits for improving road safety. The upcoming 5G network will further empower connected vehicle technology and get us to a safer transport future by allowing for better latency, accuracy and vast data exchange.



SELF-CONTROL

Automated vehicles are fast becoming a reality, whether it is a self-steering Hyundai or Highway Auto-Drive Mercedes-Benz, the majority of new vehicles from 2018 are equipped with Auto-emergency braking, lane departure warning and blind-spot monitoring. These features assist in the reduction of crashes (according to ANCAP) and provide safer manoeuvring of the vehicles. However, it also means that our driving test and education needs an update. Technologies such as vehicle to vehicle communication or vehicle to infrastructure communication will be vital in combatting fatalities. This vital information will alert drivers and authorities to potential risks and dangers prior to the event.

Imagine as the first vehicle detects 'black-ice' on a curvature road, it activates its safety features but at the same time, sends information to other drivers about the location and potential dangers. This same signal is also broadcast to the visual Traffic Message Board of the danger and reduces the speed to a safer approach. These features are available overseas and will make its way to Australia.

In an article by Stuff magazine [March 2015], it was mentioned how a racing car driver was beaten by an automated vehicle of the same make and model around the same racetrack. The automated vehicle completed the one lap race in 2mins 20sec, whereas the racing car driver completed the lap 2 seconds slower.

The technology of tomorrow is at our doorsteps....

"HELLO FUTURE!"



Image from Ericsson [Ericsson, 2020]



INTEGRATED TRANSPORT ENVIRONMENT

- There are many forms of transport we use every day: cars, trains, trams, buses, bicycles. In recent years, the focus of the transport community has been placed on integration, creating a seamless, efficient multimodal Mobility as a Service (MaaS).
- A personalised and automated form of travel, where some form of mobility app will help you get to your destination based on your most preferred factors – travel time, cost, comfort, environmental impact. That may be through a driverless taxi (private or shared), bullet train, bicycle, or by walking.
- This will all require supportive ecosystems, physical and digital infrastructure, proper management and security, and an overall planning, booking and payment service. Ambitious, but possible, and absolutely necessary for a safer, cleaner and more productive future.

Example of the Mobility as a Service (MaaS concept)" abstracted from NSW Future Transport Strategy 2056

SAFETY OF THE FUTURE

With the introduction of seatbelts, airbags and random breath testing, the road toll in Australia and across the world has severely reduced since 1970. However, hundreds of people are still fatally killed or seriously injured on roads every day; so what will it take to reach zero?

While the major keys to safety in the past have been vehicle technology and driver influence, they may not be in the future... In the hierachy of controls (below), we see administrative education and engineering technology that have helped us get this far. But a focus on the way our transport environment is built may be the last key to zero.

Road infrastructure and its connectivity to vehicles are becoming increasingly important, such as for in-vehicle speed limit restrictions and nearby collision alerts. While the two aspects of CAVs (connected and automated vehicles) are often put together, connectivity may improve safety long before the introduction of level 5 automated vehicles.



Future Road by City of London, separating different magnitudes of kinetic energy

HIERARCHY OF CONTROLS



"ITAI-DOSHIN" – MANY IN BODY, ONE IN MIND

With the race towards automation, it is important to approach the technology with a holistic view and appreciate it will not happen overnight, but it will happen eventually. Over the next few decades as we transition across to highly automated vehicles, it is crucial to acknowledge the vast amount of challenges to achieve this feat.

Some of the considerations to be resolved are being investigated by engineers, scientists and legal eagles, such as how vehicle sensors detect in cold, fog or rainy conditions, or how does the automated system interact with non-system driven vehicles as there are no gestures or eye contact from the driver, or how does the vehicle drive when the high definition maps are out of date and cannot synchronise, or what are the responsibilities of the insurance companies should an accident occur during a transitional phase from driver to system (evidential), or what is the role of regulations during transition and operational phases?

It is a global race towards automation and Australia with its vast appetite for latest innovative technology and as pioneers of some of these technologies, it needs to have a holistic and visionary approach.

ARRB has been commissioned to undertake some of these studies and research with the results being shared amongst governments, academics and commercial entities.

If interested, please log on to arrb.com.au to find out more about this exciting and innovative developing technology and other exciting news about mobility, transport and road infrastructure.



CONCLUDING REMARKS

The taste of the future is within our grasp. We have been very fortunate to have been served these technologies of the future, today. It will only be a matter of time before these life-saving technologies are standard across everyday vehicles, whether owned by us or fleet managers. We have witnessed the transformation of the horse and carriage to the automobile and the amazing moon landing. Over the next 30 years, it will be a drastic evolution of technology, just like the humble calculator to modern smart mobile phones.

We may no longer need to wait for the shops to open in the morning or afraid to go out late in the evening to purchase some shopping as the shopping will come to you, thanks to the advancement in automated vehicle technologies.

New age vehicles encompassing big data analytics are creating new possibilities for consumers and engineers alike.

Established automakers and new venture start-ups will both be competing in the same space and contribute towards this advancement in technology. Some governments are starting to mandate these technologies in the vehicles or outlaw traditional ICE from their city centres.

Will Australian cities do the same?

What are the impacts and benefits?

What research and studies or contributions have ARRB undertaken?

Where can I find out more information?

In concluding, the big winner must be 'Safety' and the vision 'Towards Zero'? We can do more than just rely on technology.

Hello Future, your technology is served

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