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Driverless Cars – How Long Will It Take Them to Become a Reality?

by James Hahm, Gen Re, Sydney

Not long ago the industry was awash with news about how driverless cars would change the face of motor insurance forever. Nearly every major insurance seminar included a topic on the subject. With 2020 just around the corner, how is the journey progressing?

The buzz has died down a little, but the race continues, and most major consulting firms and insurers are eagerly monitoring developments in the autonomous vehicle (AV) field.[1] This includes KPMG, who publishes an Autonomous Vehicles Readiness Index to "assess countries' preparedness for autonomous vehicles".

In their most recent report, KPMG comments on the huge acceleration seen recently both in AV funding and the passing of legislation required to permit autonomous vehicles access to public roads.[2] However, exactly when self-driving vehicles where the fallback and final responsible entity is the autonomous system (i.e., levels 4 and 5 according to the Society of Automobile Engineers index), will become commonplace is still unclear.

The current picture

In 2017, a report from insurer NRMA anticipated fully driverless vehicles would be on our roads by 2025.[3] In 2018, Insurance Australia Group Limited (IAG) predicted that penetration of fully driverless cars would be 14% by 2040.[4] Are these predictions realistic?

Let's look at the money trail. Right now, the driverless car game is limited to major corporations with billion-dollar balance sheets. Ford has allocated USD 4 billion for the development of its self-driving cars and Cruise (General Motors) has raised USD 3.9 billion this year alone. Waymo (formerly Google, now Alphabet Inc.) reportedly costs USD 1 billion a year to run.

A big balance sheet certainly grants a significant amount of momentum. In 2018, Waymo completed the most on-road testing, driving 1.2 million miles in California, Cruise was second, driving 448,000 miles, and Apple third with 80,000 miles.[5] In

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terms of disengagement[6] (i.e., human interventions) during on-road testing, Waymo reported that a disengagement occurred on average once every 11,018 miles, while Cruise averaged a disengagement every 5,205 miles, and Apple every mile.[7, 8]

Despite the billions of dollars invested, these prototype AVs remain very much "in testing". Having boldly stated that they would have level 5 driverless vehicles by 2019, both GM and Tesla have since extended their timelines.[9] Ford has also scaled back its projection, stating that the original timelines were overly optimistic.[10]

What's around the bend?

It's clear that assisted-driving technology is here to stay. Over the next few years, we will continue to see an electronics boom that will improve the driving experience and safety of our cars. However, these technologies are fundamentally designed to enhance and not replace the human driver. To make driverless cars a reality (i.e., levels 4 & 5) there are, in my opinion, two possible approaches.

The spatial/geo-fenced or tracked approach

This approach involves modifying the roads that driverless cars are driven on as well as the cars themselves, akin to making cars into a virtual train with virtual tracks. A central system, operated by the road owner, would monitor and optimise the position and speed vectors of all the cars on the track leading to efficient and safe travel.

The technology for this approach already exists and, with a willing government, it could be implemented in a relatively short amount of time. Only vehicles equipped for the track would be allowed as even a single non-conforming vehicle would increase complexity exponentially. A certain uniformity would therefore be necessary and, if this system were adopted, we would see a staged evolution in which all cars would eventually be fitted with suitable devices.

The biggest barrier is the high cost of setting up this infrastructure on the roads, analogous to some rail systems. However, precedents for dealing with some of the legal and liability issues are already in place - multi-jurisdictional liability for the "virtual track" could be based on European rail networks. Liability for the systems on the cars could rest with the individual owners/manufacturers, again based on the laws of the rail networks. Driverless subway trains are already in operation in some parts of the world and we will likely see some relevant legal precedents arising from this area in the near future.

The 10 Countries Most Prepared for Autonomous Vehicles

The KPMG Autonomous Vehicles Readiness Index assesses a countries' preparedness for autonomous vehicles, based on four pillars: policy and legislation, technology and innovation, infrastructure, and consumer acceptance.

1. The Netherlands
2. Singapore
3. Norway
4. United States
5. Sweden
6. Finland
7. United Kingdom
8. Germany
9. United Arab Emirates
10. Japan

Source: KPMG Autonomous Vehicles Readiness Index 2019

Simulating human drivers

The second approach is a system that emulates a human driver. Level 4 and 5 automation (where the system is the fallback and final responsible entity) is the ultimate goal of driverless vehicle manufacturers. However, this approach has significant hurdles, not least of which is the legal treatment.

Traditionally, individual human drivers are held individually accountable. By contrast, driverless vehicle manufacturers will be held liable for the entire group of products potentially affected by the at fault issue. Due to this, and the potentially life-threatening consequences of any defects, the standard of accountability is understandably high. An analogy can be drawn with medical devices. For example, in a case involving pacemakers, an EU court ruled that if products belonging to the same group or production series have a potential defect, it's possible to classify all the products in that group or series as also being defective, without the need to prove that the individual product in question is itself defective.[11]

How can this vulnerability be addressed? One way is to build up empirical data to indicate the safety of the system. Assume a black box driverless driving system exists that can drive a vehicle with a much lower frequency of incidents compared with a human driver. Such a system would need

to convince the most conservative lawmakers of its viability. This could take many years, or even decades, which again draws parallels with medical devices.

Driverless vehicle manufacturers have already seen their timelines set back by high-profile accidents and fatalities that occurred due to an overextension of a premature technology. To provide some perspective, statistics for human drivers show that roughly 1.8 fatalities occur every 100 million miles in the U.S.[12] Waymo claims it has now logged over 10 million real-world miles, far more than comparable companies.[13] Since 2016, five fatalities have occurred involving automated vehicles.[14] Though artificial, extrapolating these numbers may mean that 270 million more real-world miles need to be undertaken by driverless vehicles (without any further fatalities) before the technology is even on a par with the human error rate.

The above inference also assumes that a system is sufficiently advanced to drive itself and respond to the myriad exceptional circumstances that can occur on roads. Given the extremely low error rates required, such systems would have to be able to handle these exceptions beyond the augmented human driver level. Considering that the inputs available would have similar limitations to that of an augmented human driver, only a system that is more capable than a human would be able to accomplish this.

This raises an important question: How does the legal system deal with an intelligence/system that is more capable of interacting with the real word than a human? This issue is likely to spark much debate, extending beyond the scope of driverless vehicles into how we would deal with a "real" artificial intelligence (AI).

Such systems are still way in the future. When they do exist, the real challenge will be building trust in the capabilities of such an intelligence. This would likely be achieved only through long and rigorous testing, and, with the current industry practice of testing a technology still in development, it raises a classic chicken or egg dilemma for the AV industry.

Conclusion

Assisted-driving technology will become a major industry business component. While having driverless vehicles on geo-fenced roads is technically already possible, the actualisation and growth of such a network of roads will be driven by government and limited by costs.

Companies and countries that are undertaking the testing of driverless vehicles in a non-spatial or geo-fenced environment are testing a technology still in development and need to ensure that enough safeguards are in place or face possible legal exposures.

The marker for the maturity of this technology will be the development of a "true" AI and its legal acknowledgment. The development of such a system will likely have a profound affect on society and will not be limited to driverless cars. Given the amount of investment being pumped into developing AI for self-driving cars at present, it's perhaps unsurprising that the AV industry is a frontrunner in the AI race.

About the Author

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Endnotes

1 By way of example, companies including McKinsey, Suncorp, Insurance Australia Group Limited (IAG), and KPMG are all actively following developments in the AV field.

2 KPMG 2019 Autonomous Vehicles Readiness Index. Countries and states including the Netherlands, the United Kingdom, Australia, France, and California have passed or are passing legislation opening AVs' access to public roads. Trials are underway from Singapore to Madrid to Gothenburg.

3 The Future of Car Ownership (August 2017) – https://www.mynrma.com.au/community/news-and-media-centre/autonomous-cars-in-australia-by-2025

4 https://www.iag.com.au/sites/default/files/Documents/Announcements/IAG-2018-Investor-Day-5-Zone-Future-of-motor-insurance.pdf

5 https://www.theatlantic.com/technology/archive/2019/02/the-latest-self-driving-car-statistics-from-california/582763/

6 Note that what constitutes a "disengagement" is not subject to an industry standard and is determined by individual companies.

7 https://www.bizjournals.com/sanfrancisco/news/2019/02/14/av-makers-reveal-their-2018-driving-record.html

8 https://www.bloomberg.com/news/articles/2019-02-13/apple-s-autonomous-cars-need-much-more-human-help-than-rivals

9 https://emerj.com/ai-adoption-timelines/self-driving-car-timeline-themselves-top-11-automakers/, https://www.svb.com/globalassets/library/uploadedfiles/content/trends_and_insights/reports/future-of-mobility-report2019.pdf

10 https://www.engadget.com/2019/04/10/ford-ceo-says-the-company-overestimated-self-driving-cars/

11 Boston Scientific Medizintechnik GmbH v AOK Sachsen-Anhalt – Die Gesundheitskasse (C-503/13), Betriebskrankenkasse RWE (C-504/13)

12 In 2016 and US only. https://www.washingtonpost.com/opinions/no-driverless-cars-arent-far-safer-than-human-drivers/2018/03/20/5dc77f42-2ba9-11e8-8ad6-fbc50284fce8_story.html, https://www.nhtsa.gov/press-releases/usdot-releases-2016-fatal-traffic-crash-data

13 https://techcrunch.com/2019/07/10/waymo-has-now-driven-10-billion-autonomous-miles-in-simulation/

14 Note: these were in level 2 and 3 automated vehicles where the fall back was the human driver. There is a significant gap between consumer perceptions of the state of the industry and technology, and the actual reality.

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