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NEWS RELEASE

# Self-Driving Cars – How Far From Reality?

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In the last couple of years, we have witnessed a phenomenal change within the automotive sector in terms of electronics, use of machine learning algorithms and the integration of more sensors. Moore's Law* may no longer be applicable in terms of the increase in the number of transistors in a chip, but it can still be applied for the growing number of sensors in an automobile.

In terms of features in vehicles, the biggest beneficiary of these adaptations is advanced driver assistance systems (ADAS). With radar, Lidar, infrared, ultrasonic, camera and other sensors, the development in ADAS has reached a stage that could allow for the deployment of a "completely independent" self-driving vehicle in the near future. In fact, vehicles with self-driving features like self-acceleration, self-braking and self-steering are already on the road.

A simple Google search of "Autonomous Cars" would convince most people that self-driving cars are just around the corner. Yet, even with the many leaps taken by the industry to adapt to the latest technologies, we are still lacking in terms of infrastructure. Self-driving cars require extensive ground support in terms of vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V) and vehicle-to-surroundings (V2X). Some of the immediate requirements for self-driving cars to become a reality are discussed below.

Every country, many states, and sometimes even municipalities have special road signs. A self-driving car needs to be capable of identifying, reading, decoding and processing each of those road signs. This problem can be approached in two ways – either the industry and governments need to develop "coherent road signs," or a central database of all possible road signs must be created and stored in the vehicle electronics so the car can react

appropriately to specific signs.

One can argue that a car navigation system should provide the information regarding road signs, but this technology has limitations with periodic updates and also requires a constant connection to the Internet or GPS. This limits a self-driving car's access to properly mapped geographical locations and, in the true sense, would not constitute a self-driving feature.

Another immediate requirement for a self-driving car is the capability to communicate with other vehicles on the road, but not through existing telecommunication technologies like 4G, Wi-Fi or satellite. The dependence of self-driving cars on these technologies will limit them to areas where this infrastructure is available, while also requiring a very high quality of service to determine real-time communications.

The use of existing telecommunications technology in cars will make them subject to network jams as well as making the car susceptible to cyber-attacks. This could compromise the safety of passengers in a self-driving vehicle. V2V communication needs to take place directly and without any dependence on external telecommunication infrastructure. The best possible case is to develop a real-time negotiating network protocol for the communication between cars, with an additional dedicated layer of security."

Lastly, and perhaps most importantly, self-driving cars need to behave like a human driver. This means the cars not only require a camera to analyze the surroundings, but also need a sophisticated array of microphones to listen to the surroundings or user commands. The vehicle should be able to process this audible information and integrate it within its existing information processing architecture to make intelligent and independent decisions. Like humans, a self-driving car needs to have "eyes and ears."

Semi-autonomous cars are already a reality and by the year 2020 they will be very visible on roads. However, self-driving cars may need more time to come to fruition on public highways. The industry needs to develop more sophisticated sensors, machine learning algorithms to process the data from these sensors, and an innovative sensor fusion. If these needs are addressed, we may begin to see the first prototype of the self-driving car in a true sense by 2025.

* Moore's Law is a computing term which originated in 1965. Gordon Moore, co-founder of Intel, stated that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. Although the pace has slowed in subsequent years, most experts, including Moore himself, expect Moore's Law to hold for at least another two decades. Source: **www.mooreslaw.org**

As a software expert, Anshul is involved in the development of SmartCore™ (shown above) and is currently working on the development of audio features and signal processing modules. He is also focused on self-driving car technologies and the effect of the Internet of Things on automobiles. Anshul is based in Karlsruhe, Germany.