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# The Effect of Autonomous Vehicle on Road Safety

As the technology developed, more technological inventions are occupying the daily lives of mankind, and now artificial intelligence and robots have hit the road, it is time to consider what effect they have brought to human drivers. As the autonomous driving system are featured to be making fewer mistakes than human, they are claiming to replace human drivers in the future and increase the safety of both the passengers and pedestrians. Avoiding mistakes and exceeding human driver performance making these autonomous vehicles seems flawless. With the ability to calculate the situations on the road in milliseconds, avoiding problems like a drunk and drive or exceed the speed limit, it does propose a more safety road environment for us.

In 2005, the simulations and researches of autonomous vehicles on the road is already going under the Nation Institute of Standards and Technology, by Schleoff, Ajot, and Madhavan(2005). In “Performance evaluation of autonomous vehicle navigation in dynamic, on-road environments”, Schleoff introduced a simulation of situations on the road, and the system reacts perfectly by stopping or slowing to dynamic objects in front of the vehicle, changing lanes when the next lane is clear and going slower than desired to keep a safer distance. These actions, described by Schleoff, place the vehicle out of a potentially dangerous circumstances in city street or on the highway. Actions are pre-calculated by specific algorithms fitting corresponding situations on the road. Algorithms has developed to test all the acceleration situations are made example here, with possible values of Quick Acceleration(QA), Slow Acceleration(SA), Keep

the same Speed(KS), Slow Deceleration(SD) and Quick Deceleration(QD) and other fifteen environment handling algorithms, it is able to handle almost every single possible acceleration situation on the road like changing lanes or passing other vehicles. However, these algorithms can only handle situations of moving or static object like other vehicles and obstacles, interaction with human pedestrians are not included in here.

With the system develop algorithm exponentially, in recent time the autonomous vehicle technology has a huge breakthrough, but more challenges reside within human self. Driving in the human world isn't easy for autonomous vehicles. To drive safely, according to Sandy Ong(2017), the system must think like the human, predict what a human will do on the road and react to them in milliseconds of time. Ong states that even though the autonomous system can do much more for us nowadays, like cruise down a motorway, creep along in a bumper-to-bumper traffic and even do a dreaded parallel parking, react to all scenario on the road is not easy. Interactive design of the system is not easy to design, especially handling all special cases on the road, like what the car will interact with a man riding a donkey, blowing a horn and sing along on the highway. Other question arises when machines cannot think like human being, as human are bounded by moral reasoning. One special case of moral decisions is made by Ong questioning dilemma on moral reasoning. Ong proposes this intricate problem: avoiding an incoming vehicle to protect the safety of passengers, but you will ram into a crowd of pedestrians. Moral and philosophy questions arise when developing codes facing moral dilemmas, it illustrates that engineer cannot make moral decisions behind the computer for everyone driving an autonomous vehicle. As autonomous vehicles cannot make decisions like the human, it will face more dilemmas on the road, increasing the risk of both passengers and pedestrians.

Human mistakes are also a huge obstacle the autonomous vehicle facing, the current system generally gives a systematic credit for human drivers ultimately being responsible for safety, stated by Philip Koopman and Michael Wagner(2017) in “Autonomous Vehicle Safety: An Interdisciplinary Challenge”. System cannot cover all the emergency situation on road, and one must be responsible for their own safety on the road while sitting on one of those auto-driving vehicles. A significant safety certification concern is validating any use by autonomous vehicles of self-adaptive system behavior, it means the system might react to the situation differently sometimes in a simulation. Unless limits are somehow put on the adaptation, this kind of system is impossible to ensure safety, of such a system might not behave regularly every time. Formal approaches are considering of calculating and importing every single emergency situation on the road, but that is evenly impossible as the aforementioned method. As human drivers now are responsible for their own safety while driving the autonomous vehicle, it is unsure how the system will react to protect the driver’s safety.

Some might think, even as the autonomous vehicle fail to function, a human intervention might suit for the autonomous vehicle on road. Current implement autonomous vehicle all have a manual mode in case something happened to the system or situations the computer could not compile. In “Autonomous Vehicles: Disengagements, Accidents, and Reaction Times”, by Dixit, Chand and Nair(2016) of UNSW Australia, introduced the data of reaction time experience by most autonomous car driver. It is about 0.83 seconds for the system to hand the control to the drivers and as the driver to react to the situation as such. Fast processing power from the autonomous system benefits the driver more than anything else, as the computer cannot go wrong from deciding an action, with the major flaw comes from outside human interactions. From their data, the current accident report that most accidents of autonomous vehicle happened

in the slow speed and only one out of twelve is attributed to the system's fault. This fact proves processing and calculating power provide by the system certainly can improve the safety of the passenger onboard.

Other studies pronounce that autonomous vehicles can potentially save thousands of lives and hundreds of billions of dollars. In "Robocars would Save Human Lives" on Mechanical Engineering(2016) magazine, it mentioned Dr. Christ T. Hendrickson from Carnegie-Mellon University has conducted a research on several specific parts of autonomous vehicles, Hendrickson focused on functions like lane departure warning, blind spot monitoring, and forward collision warning. If these technologies are fully in effect of every single vehicle in the United States, Hendrickson predicts that it would prevent or reduce 133,000 injury crashes and 10,100 fatal crashes. On base on the best case scenario, it would save the United States $202 billion in accident costs, this cost is based on the average cost of average cost of a car accident, include $47,021 in economic cost and $115,414 in quality-adjusted life years, a measure takes into account of changes in health and lifespan due to an accident. This study is only based on the specific parts of the autonomous vehicles, as implementing them on the partially autonomous vehicles is also helpful for increasing road safety.

Reviewing these articles leads back to the question: can the autonomous car provide more road safety or increase the risk on the road? Analyzing both the effect on the passengers and pedestrians, it is still unsure how the autonomous vehicle will lead us to a safety road environment or not. However, with both the progression of engineering and development of a more interactive system, we might someday in the future see these unmanned vehicles on road.

Works Cited

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