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The Need For V2V Communication

Although cars are an essential part of our lives, due to climate change, human and mechanical error, and traffic congestion, the way that we use our vehicles needs to change. We need to find a way that will make vehicles safer, more efficient, and ecofriendly. A new technology that may revolutionize vehicles and fix these problems is the development of a fully autonomous vehicle that utilizes vehicle to vehicle communication in order to avoid accidents, improve traffic flow, and provide optimum fuel consumption. Currently, autonomous cars are being developed by car companies such as such as General Motors, Toyota, Volvo, Volkswagen and BMW as well as Internet auto companies such as Google, Uber and Tesla, but they are currently 5 times as likely to crash as a conventional car (Ali). This is because they do not currently fully utilize Vehicle to Vehicle communication (V2V).

According to the DMV, within the US in the year 2016, there were 7,277,000 reported motor accidents (DMV). Human error was found to be a definite or probable cause in 90-93% of motor accidents, according to the Tri - Level Study of the Causes of Traffic Accidents published in 1979(Rowley). In 2016, of the 35,092 motor accident fatalities, 29% were caused by alcohol-impaired drivers, 27% by over-speeding drivers, and 10% by distracted drivers (Ali). Therefore, if human error was removed, it is possible that 6,767,610 motor accidents could have been avoided. If possible, then this would have saved nearly 300,000 lives in a decade, and in one year would have saved 190 billion dollars in healthcare savings (Rowley).

Another major problem associated with motor vehicles is carbon emissions, part of which is caused by traffic congestion. Traffic congestion could be solved from the use of V2V autonomous cars through the use of clusters, platoons and multi-platoons. Clusters, platoons and multi-platoons all work by creating a hieratical network structure. A cluster is formed from groups of cars based on their geographic location and their speed. A platoon is a cluster that is made up of a string of cars that move together at the same speed with the same distance between them. Each platoon is led by a autonomous vehicle with the rest following at a set distance like a train. It has been found through simulations that this would improve traffic efficiency by 30%. A multi-platoon is made from many different platoons and would organize itself based on the most efficient algorithms for speed and safety. Simulations have found that this would achieve high traffic capacity values with little congestion (Wang).

A single passenger car will release an estimated 4.6 metric tons of carbon dioxide per year. This amounts to nearly 1/5th of all US carbon emissions. A way to reduce this would be to create a shared autonomous vehicle (SAV), which uber has been trying to do. A SAV is an autonomous taxi that would provide point to point travel for passengers. Passengers would schedule a time for pickup and drop off, and would “share” the vehicle with others. It has been found that one SAV could replace between 3 and 11 personal vehicles on the road, and that between 14% and 39% of travelers would choose to use SAVs. This would also reduce the space needed for parking lots allowing for more businesses and living spaces (Levin). Another way that we could curb carbon emissions with the use of autonomous vehicles is through real time energy management. Autonomous vehicles could accurately predict ideal velocity to improve fuel efficiency. This is known as Equivalent Consumption Minimization Strategy (ECMS) and was found to improve fuel efficiency by 5% (Zhang).

Autonomous vehicles (AV) are an inevitable future due to the vast benefits that they will have on our society, however in order to get there, V2V communication will need to implemented. Conventional cars are still 5 times safer to drive then AV. This is because even in the best vehicles there are, sensors can be unreliable with identifying situations and have a certain range of vision. It is due to these problems that tesla’s AV were involved in 5 fatalities and 1 in Uber. V2V would also need to be implemented in order for AV’s to efficiently alleviate congestion.

The problems with AV relying solely on sensors affects both the safety and the maneuverability of the vehicle. Sensors can be unreliable because they lack the knowledge of their surroundings and are narrow in scope. In May of 2016 a tesla killed its driver by driving into a truck. This was because the sensor was blocked from sight due to a white towed car corner. They may also make incorrect decisions such as when an Uber AV in 2018 killed a pedestrian due to misreading their location and assuming they were further away than they were. The risk increases when placed in complex intersections with high pedestrian and traffic flow, as well as with bad weather including snow or ice. Problems also arise when there are irregularities such a faulty traffic lights, missing signs, or faded street paint. The only current solution being utilized for these problems is the addition of more sensors to cover more space and to try and analyze as much as possible. This increases the price of AV’s, as some sensors can be priced at $75000.

By relying solely on sensors AV’s become much more expensive and haven’t become safer than a conventional car. This could be entirely changed with Vehicle to Vehicle communication. With V2V communication, AV’s would have a shared input of their surroundings, so speed signs, locations, road conditions, as well as accidents would all be shared. This would increase reliability, as even if a sensor makes a mistake, when checked with other vehicles the right decision may be made. This also increases the area that the AV has knowledge of so in the case of an emergency, it would have more time to react and slow. In the case that a vehicle runs a red light, the sensors of the car may only have a vision of 6.6m, resulting in a collision. However, by communicating with other vehicles, that vision is increased and would allow the AV time to stop to avoid someone running the red light. V2V also increases how well the vehicle maneuvers. It was found that when using V2V communication, basic tasks such as merging or making turns were found to happen up to 50% faster (Ali). V2V also allows for cars to find the most efficient way to navigate traffic, forming clusters, platoons and multi-platoons while also finding the most fuel-efficient speeds to drive at. Autonomous cars are the future, but in order for them to take over the world like the original cars did, they will need to implement a V2V communication system.

Works Cited

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