WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Self-Driving Vehicles: Aftermath, Automation, Review & Levels

Aasim Shaikh

Student, Department of Mechanical Engineering,
Sanghavi College of Engineering, Nashik, India.

ABSTRACT:

Self-Driving vehicles also known as autonomous vehicles are the one that require no human contact for controlling and operation. Now a day's development in self driving vehicle has advanced but still human contact is required. Various experts say that within a span of 4 to 8 years automobile companies will be able to make totally self- driven cars. This paper describes recent status, ongoing trends and research of autonomous vehicle in automobile industry. A detailed anatomy of technologies used by self-driving vehicles to percept their environment and the automation level is also mentioned. The advantages and disadvantages, shortcomings of autonomous vehicle such as harmful gas emission, consumption of energy etc. are also included. As extensive adoption of autonomous vehicle is considered to be inescapable, hence necessities of certain technical and legal regulations will be necessary for secure and worry free travel.

KEYWORDS: Self-Driving, autonomous vehicle, emission, application, technology, aftermath, sensors, lidar.

INTRODUCTION:

Self-driving vehicles have been generating significant importance, lately each automobile industry is in an initiative to make their own self-driving vehicle and are also pretty much successful. They are also set to start their production in a span of few years. Though people are a bit sceptical with the idea of autonomous vehicle. But their acceptance or rejection totally depends on the success of this technology. Various studies have already been started relating to self-driving vehicles impact on emission, cars per person, etc. They all say that the technology must surpass human driving skills. But there is no denial in the fact that it will have a huge influence on transportation technologies.

RESEARCH AND ONGOING STATUS:

The auto sector is briskly evolving and now with the concept of autonomous car, almost every company is making self-driving cars. Companies like Uber and Google which aren't automotive companies are on there way of developing driverless vehicles.

- Titan which is autonomous car project is in development stage by Apple.
- Electric cars are already booming. Companies like Tesla and General Motors have their cars already for sell for consumers but self-driving vehicles are still developing but there are cars which have some exemplary features like Super cruise control of General Motors and Autopilot of Tesla.
- Iseean MIT Spin-off is developing and testing driverless vehicle using artificial intelligence. There is also YOLO(you only look once) an object detecting feature, which is developed by JoesphRedmon.
- Faurecia the component maker has proposed the cockpit for driverless car. When self-driving mode is clicked, The steering wheel automatically folds and the screen which is behind comes to the center of the dashboard.
- The subordinate Parent company of Google Waymo has build a self-driving concept car which they are testing.
- They are also on there way of producing self-driving trucks.
- Aston martin also launched its concept car Lagonda a vision concept which is level 4 autonomous car.
- Symboiz a concept car by Renault also has level 4 autonomy and can also be driven manually.
- Much Progress is done in this field. But the above mentioned points are written to demonstrate the significance and zeal regarding driverless cars.

DIFFERENT TYPES OF SENSOR AND TECHNOLOGIES:

Driverless cars are developed using intricate algorithms, improved technologies and unbiased networks. In this section all the sensor technologies used by autonomous vehicle have been mentioned.

ULTRASONIC SENSOR:

Ultrasonic sound waves have frequency which is greater than 20,000hz. Near by objects are located by this sensor.

The surrounding is mapped as the waves touch the object and are reflected back.

- Submarines and boats use the same concept of sonar.
- Echolocation is the concept used by bats to navigate.
- Automatic parking is possible through this sensor but at minimum speed.

IMAGE SENSOR:

Number of cameras are set on the vehicle which capture image of the surrounding. Traffic signals, signs and lights are easily understood. But they come with a drawback, it's difficult for the sensor during rainfall and fog.

RADAR SENSOR:

(Radar) Radio Detection and Ranging Sensor throws radio waves which are high frequency. The speciality of this sensor is it creates echo once it comes in contact with other objects. This echo is then interpreted by the antenna which tells the system about the position and speed of the object.

- Aircrafts and ships extensively use Radar technology.
- Tesla is also using it in some of their autopilot cars.
- The return signal is a bit difficult to understand in high packed space or a completely open field.

LIDAR SENSOR:

(lidar) light detection and ranging. This was developed to bridle the difficulties faced by radar. The sensor uses very minimum intensity and absolutely harmless laser beam for scanning the environment. A real time virtual 3d environment is generated by using software which combines data of both camera and sensor. This sensor have high price than radar sensor. Companies like Uber and Google are using it.

STEPS OF AUTOMATION:

Self-driving vehicles are divided on the basis of levels of automation (NHTSA) National Highway Traffic Safety administration USA gave the first classification in 2013. But SAE in 2016 introduced its six levels of automation which is now set as international standard for all self-driving vehicles.

STEP 0: ZERO AUTOMATION:

When vehicle control that is braking, acceleration, steering is in driver's hand that is zero automation vehicles which have system like oil pressure, coolant temperature sensing are also considered in zero automation.

STEP 1: ASSISTANCE OF DRIVER:

Features like (LKA) lane keeping assistance which help the car to steer in a lane and (ACC) Adaptive cruise control fall in the category of assistance of driver. This system work on their own but requires input from the driver. Many vehicles use this feature like Mercedez, Audi.

STEP2: PARTIAL AUTOMATION:

This is a level in which driver must be ready to take the control of car. Although features like acceleration/deceleration, Steering, braking are present. There are some cars with this level available in the market.

STEP3: CONDITION AUTOMATION:

This level car uses Radar technology driver only needs to control when system says it. Super cruise control technology of General Motors, Audi A8, Auto pilot of Tesla has this level of automation.

STEP4: HIGH AUTOMATION:

Features like emergency braking is possible this level of automation. It's ok if driver is not on driver seat and the attention of driver is not needed. But in case of certain circumstances driver can take control. Google's vehicle is an example of this level of automation.

STEP5: FULLY AUTOMATED:

This vehicle does not need any driver assistance. The driver is not allowed to take the control. Robotic Taxi is an example.

APPLICATION AND AFTERMATH:

The aftermath on self-driving vehicle on emission, economy and people's acceptance is mentioned in this section.

Number of accidents will be reduced as driverless cars does not get distracted or is exhausted and also has safety features like Airbag and ABS. As the driving of autonomous vehicle will be free from human errors it will safe life and money. Cases like road rages will also substantially reduce.The driver of cars can use this time for some other work likerelaxing or entertainment, which in turn can add revenue to telecom industry.The concept called Platooning which when means when number of vehicles are travelling closely, there is reduction in aerodynamic drag which increase efficiency

of car, and also contributes in the reduction of fuel consumption. Platooning is only possible in autonomous vehicles, but in case of manual car's it is not possible. Platooning also helps in reducing road traffic as car moves in a lane.

The speed of autonomous car can be increased as there is no chance of failure of computer system. Due to this feature journey time will be reduced also smoother and jerk free experience.The efficiency of vehicle will be increased to a great extent as self-driving cars would drive cars in most efficient manner. As the cars would be self-driven certain parameters would be set which would cause less wear and tear of vehicle parts.Driver related jobs will be greatly affected as no more drivers will be required. This would affect economy greatly hence tackling this issue is a concern. Therefore this new technology should be slowly brought in the market.The space required for parking will be reduced and can be used for other purpose like parks.The crimes associated with traffic will be reduced to almost zero and much better traffic control can be seen.Emission will depend on human interaction as no driver is required so people would tend to go on longer drive.

APPLICATIONS:

- Autonomous cars can be used for daily commute.
- This can also be used as self-driving taxi.
- The truck industry that is transport through truck can also use this.
- It can be used by people with disabilities.

POSSIBLE CONCERN:

People are excited about autonomous cars but there are concern relating to law and safety.

- There are various studies which says that while a car is in self-driving mode the driver tend to pay less attention and due to which in case of emergency it is difficult for him to respond.
- As the car uses GPS privacy would be affected as real time location of car would be known.
- The vehicle should be available to take decisions like human, for example in case of accident a human would crash his car to save a pedestrian.
- The loss in economy because of driver related job should be well-handled.
- The vehicle law has to be updated for driverless vehicle.
- The vehicle could be used in illegal activities like terrorism, bombing or even smuggling. This should be checked.
- The vehicle needs to be checked from time to time to avoid failure.
- The maintenance and service cost of the car would tend to be on higher side.
- The vehicle should have the ability to sense animals on street and must be able to tackle such situations.
- Corner sensing is a bit difficult.
- It is difficult to sense people in different weather conditions like fog, rain, snow.
- Reprogramming can be done in software of the vehicle which can cause accidents.
- Terrain roads, hilly roads, potholes, bumps, this all must be well calibrated by the car.
- High intensity traffic, people on the street would be a matter of challenge for self-driving vehicles.

CONCLUSION:

The automotive sector is booming day by day and so is the demand from people. Various technologies have come in the market which contribute to significant increase in efficiency, performance and other technologies. This technology of self-driving car will change the experience of how people travel. There are many experts who are monitoring the advantages and disadvantages of driverless vehicle but there are surely greater advantages of this technology. Also making this technology for a betterment totally depends on human so making proper laws is essential, with more and more time, greater experience the hindrance to this technology can be improved. Hence it would not be ethical to reject this technology considering just a few aspects. There are various places where this technology can be used like truck transportation, taxi, personal commute etc.

REFERENCES:

1. Burns, L., Jordan, W., Scarborough, B., 2013, "Transforming Personal Mobility", Earth Institute, Columbia University.
2. Abbas, K.A., 1990," The Use of System Dynamics in Modelling Transportation Systems with Respect to New Cities in Egypt", System Dynamics Society Conference Proceedings.
3. Wu, C., Zhao, G., Ou, B., 2011, " A fuel economy optimization system with applications in vehicles with human drivers and autonomous vehicles", Transport.
4. Wardrop, M., 2009, "Driverless Vehicles could be on Britain's Roads in 10 years" , Telegraph.
5. Website:-https://www.gov.uk/government/speeches/driverless-vehicles-the-uses-and-benefits .
6. Bloomberg L.P.,2016, "The Merging Worlds of Technology and Cars".
7. Website:-http://www.bankrate.com/finance/auto/companies-testing-driverless-cars-2.aspx (accessed 28 November 2016)

8. Bansal, P., Kockelman, K. M., Singh, A. 2016, "Assessing public opinions of and interest in the new vehicle technologies: An Austin perspective", in *Transportation Research Part C: Emerging Technologies 67*, pp. 1-14.

9. Bloomberg L. P. ,2016, "Elon Musk Says Tesla Car-Share Network is 'the People Vs. Uber' ".

10. Wilkinson, A., Kupers, R., 2013, "Living in the Futures", Harvard Business Review.

11. Vennix, J., 1996, " Group Model Building: Facilitating Team Learning Using System Dynamics", Wiley, Chichester.

12. Townsend, A., 2014, "Re-programming Mobility: the Digital Transformation of Transportation in the United States", RudinCenter for Transportation Policy and Management.

13. Zhu, H., Yang, Z., 2011, " Simulation of the aerodynamic interaction of two generic sedans moving very closely", In: Electric Information and Control Engineering (ICEICE), 2011

14. Zabat, M., Stabile, N., Farascaroli, S., Browand, F., 1995, "The Aerodynamic Performance of Platoons: A Final Report. California Partners for Advanced Transit and Highways".

15. Pavone, M., Smith, S., Frazzoli, E., Rus, D., 2012, " Robotic Load Balancing for Mobility-on-Demand Systems", International Journal of Robotics Research 31 (7), 839–854.

16. Milakis, D., Snelder, M., van Arem, B., van Wee, B., Correia, G., 2015, " Development of automated vehicles in the Netherlands: Scenarios for 2030 and 2050", Delft.

17. NakulAudeechya, Mahesh Kumar Porwal, "LIDAR Technology and Applications".

18. Jonas, A., Shanker, R., Liu, J., Jain, P., Mehta, N., 2015, "Shared Autonomy: Put This Chart On Your Wall, It's My Sad Life", Morgan Stanley Research, New York, NY.

19. Luna-Reyes, L.F., Andersen, D.L., 2003, "Collecting and analyzing qualitative data for system dynamics: Methods and models", System Dynamics Review 19 (4), 271–296.