International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

Recent trends in Automobile Engineering Self driving /Autonomous Cars

Mrs. Poonam Amit Avinashe

Professor, Dept. of Mechanical Engineering, MAEER'S MIT Polytechnic college, Pune, Maharashtra, India

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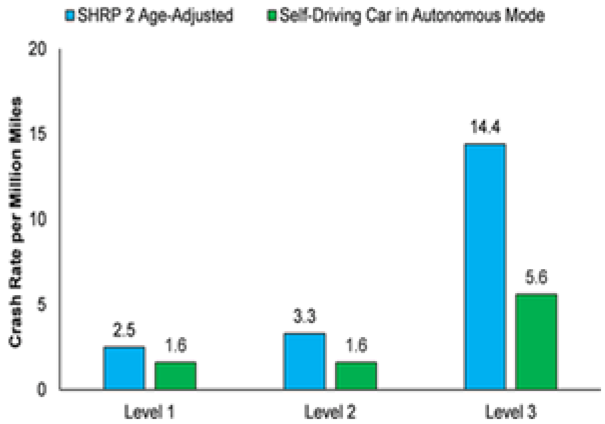
Abstract - *Cars have become increasingly safe and convenient since the rise of the commercial automobile industry in late 1980s. Recently car makers have begun to introduce advance* ***driver-assistance*** *systems such as* ***adaptive cruise control*** *(which automates accelerating and braking) and* ***active lane assist*** *(which automates steering). Researches in autonomous cars has progressed remarkably over the years and it has been found that these systems are capable enough that the new vehicles can drive themselves in slow-moving highway traffic. In 2010, four* ***driverless vans*** *traveled from Italy to China. In August of 2012, Google announced that its self-driving cars had completed over 300,000 miles of accident-free autonomous driving.*
The Electric Automobile company, ***Tesla Motors*** *came up with its first autonomous car Tesla Model X. Although self-driving cars may still seem like science fiction, many auto suppliers, and carmakers project that fully autonomous cars will be available before 2020.*
This report begins by describing the landscape and key players in the self-driving car market. Current
capabilities as well as limitations and opportunities of key enabling technologies are reviewed, along with a discussion on the impact of such advances on society and the environment. This report also reviews legal and regulatory uncertainties.
Finally, predictions about changes in the car-industry are made.

1.INTRODUCTION

A driverless car is an autonomous vehicle that can drive itself from one point to another without assistance from a driver. An autonomous vehicle is fundamentally defined as a passenger vehicle.
An autonomous vehicle is also referred to as an autopilot, driverless car, auto-drive car, or automated guided vehicle (AGV).

1.1 Purpose, Goals of Self Driving Cars & Potential Advantages

More efficient, balanced and safer transportation system. To eliminate traffic accidents caused by human errors. To eliminate traffic congestion and have smart parking solutions.



This will lead to increase the fuel efficiency and reduce carbon emission and time wasted in traffic jams and for finding parking areas. Reduce the space of parking and making it available for other infrastructure development. Increase roadways capacity as well as increase the speed limit. Autonomous vehicles could alleviate or completely solve these serious problems. Main advantages are for the automobile companies who are trying to monetize their autonomous vehicle industries. Electronics and Software companies also have equal advantage opportunities by providing their technologies and systems embedded on the vehicle.

1.2 Classification of Automated Systems

A classification system based on six different levels (ranging from none to fully automated systems) was published in 2014 by SAE International, an automotive standardization body, as Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems. This classification system is based on the amount of driver intervention and attentiveness required, rather than the vehicle capabilities, although these are very closely related. The types are:
1.Level 0: Automated system has no vehicle control, but may issue warnings.
2.Level 1: Driver must be ready to take control at any time. Automated system may include features such as Adaptive Cruise Control (ACC), Parking Assistance with automated steering, and Lane Keeping Assistance (LKA) Type II in any combination.
3.Level 2: The driver is obliged to detect objects and events and respond if the automated system fails to respond properly. The automated system executes accelerating, braking, and steering.
4.Level 3: Within known, limited environments (such as freeways), the driver can safely turn their attention away from

driving tasks, but must still be prepared to take control when needed.

5.Level 4: The automated system can control the vehicle in all but a few environments such as severe weather. The driver must enable the automated system only when it is safe to do so.

6.Level 5: Other than setting the destination and starting the system, no human intervention is required. The automatic system can drive to any location where it is legal to drive and make its own decisions. Till date, there are only high-end models of Level 3 vehicles available for drive, but that too in legal areas as these are not yet completely safe to drive.

2. Implementations & Technology

SENSORS

❖*SELF STEERING: steering systems that use camera that watch road markings and radar and laser sensors that track other objects.*

❖*LIDAR: Optical remote sensing technology to measure distance to target by illuminating with light.*

❖*GPS: Space based satellite navigation system that provides time and location information anywhere.*

❖*DGPS: Enhancement to GPS to improve location accuracy to 10 cm.*

❖*DIGITAL MAPS: Process by which a collection of data is compiled and formatted into a virtual image.*

❖*BUMPER MOUNTED RADAR: 4 radars mounted on the car's front and rear bumpers enable the car to be aware of vehicles in front of it and behind it and to keep passengers and other motorists safe by avoiding bumps and crash.*

Fig

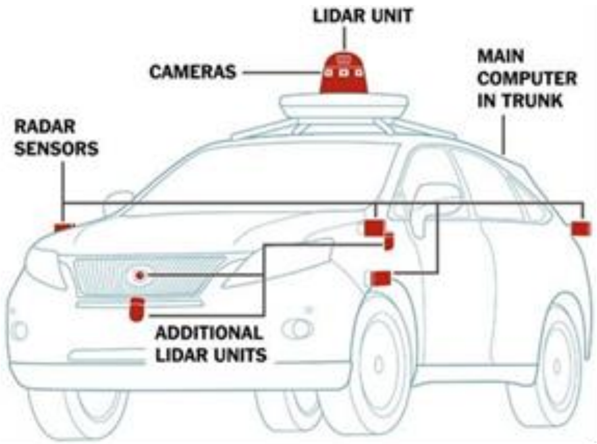


Fig -1: SENSORS

❖ *ULTRASONIC SENSORS ON REAR WHEEL:*

An ultrasonic sensor on one of the rear wheels helps keep track of the movements of the car and will alert the car about the obstacles in the rear.

❖*DEVICES WITHIN THE CAR: Inside the car are altimeters, gyroscopes, and tachymeters that determine the very precise position of the car.*

❖*PROGRAMMED TO INTERPRET COMMON ROAD SIGNS AND REAL-LIFE ROAD BEHAVIOUR:*

The software has been programmed to rightly interpret common road behavior and motorist signs. Several such programs fed into the car's CPU will work simultaneously, helping the car make safe and intelligent decisions on busy roads.

❖*MICROPHONE: Can detect sirens of approaching emergency vehicles. HIGH DEFINITION CAMS*

❖*Camera is basically the system's eyes.*

❖*They are superior to read signs, detect traffic, pedestrians, lane markings and anything else that might be in front of the vehicle.*

❖*Being the vision system, it not only detects the obstacle but also detects what the obstacle is.*

COMPUTERS AND PROCESSORS

❖*Processor is controlled basically, by Driver Px2 system.*

❖*This system will feature two Parker processors as well as two of Nvidia latest graphical processing units (GPUs) called Pascal.*

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❖Drive PX 2 delivers 24 trillion deep learning operations per second. Deep learning, a branch of machine learning, will enable the car to figure out the world around it — like, for example, if that's a dog or police car with its siren on.

❖GPUs have caught on in AI, in part, because of their ability to do "parallel computing," a technique that involves multiple calculations happening simultaneously.

COMPUTER (BLUEBOX)

❖Computers that process sensor data in real-time can vastly improve how autonomous cars make decisions on the road, whether that involves slowing down ahead of traffic jams or slamming on the brakes when a person steps into the road.

❖In the near term, Blue Box could be tested to enhance advanced driver-assisted systems that alert drivers in dangerous situations, like automatic braking and blind-spot warnings.

❖Blue Box incorporates "the embedded intelligence and machine learning required for complete situational assessments, supporting advanced classification tasks, object detection, localization, mapping and vehicle driving decisions."

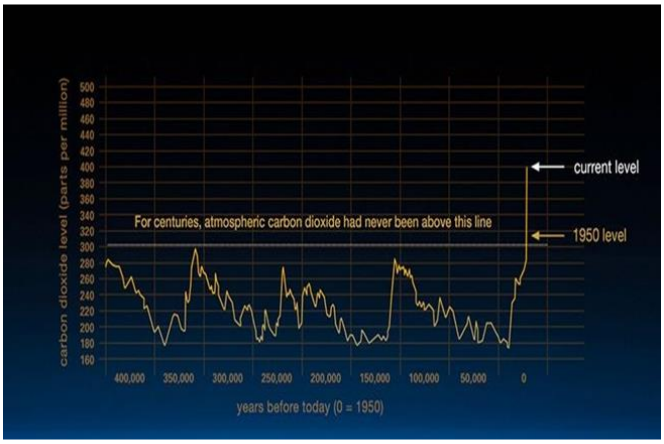
❖Blue Box is already being tested with four of the five largest automobile companies in the world.

Potential Disadvantages: Loss of driving-related jobs in the road transport industry. The automobile insurance industry might suffer as the technology makes certain aspects of these occupations obsolete. Potential loss of privacy and risks of hacking. Sharing of information through V2V (Vehicle to Vehicle) and V2I (Vehicle to Infrastructure) protocols. There is also the risk of terrorist attacks. Self-driving cars could potentially be loaded with explosives and used as bombs. There is also the risk that traffic congestion might increase, rather than decrease. Research shows that drivers in autonomous cars react later when they have to intervene in a critical situation, compared to if they were driving manually. Autonomous cars in current transportation environment is unsafe. Many autonomous car accidents have been recorded from 2011-2016 which includes vehicles of big companies like Tesla motors (Fatal accident took place in Williston, Florida on 7 May 2016 while a Tesla Model S electric car was engaged in Autopilot mode. The occupant was killed in a crash with an 18-wheel tractor-trailer)

, and Google (Google's own accident reports, their test cars have been involved in 14 collisions, of which other drivers were at fault 13 times. It was not until 2016 that the car's software caused a crash).

3. CONCLUSIONS

A recent UK study has looked at the transformative implications of
self-driving vehicles on cities. Shared autonomous vehicles could increase available urban space by 15 to 20 percent, largely through the elimination of parking spaces. Today central London has about 6.8 million parking spaces and a parking coverage of around 16%! Many large cities have even larger coverage ratios for parking space of up to 30%.
Freeing up this space would make our cities greener, increase quality of life and also create the potential for additional housing. Autonomous vehicles will also make the rural communities more attractive because shared travel to nearby cities becomes widely available, affordable and does not lead to loss of productive time. Consider autonomous vehicle only development areas and highways that are limited to autonomous vehicles. This could reduce costs as lane markings and signage would no longer be needed, the lanes could be narrower and throughput per lane would be higher.



Autonomous vehicles could greatly decrease greenhouse gas emissions in urban traffic because
Car-sharing services could offer local mobility for a highly competitive price based on a fleet of smaller, lighter cars which therefore cause fewer emissions.
Local car sharing fleets would be ideal adopters for alternative,
low-emission drives (electric cars, hydrogen, fuel cells). Because of their higher utilization levels, higher initial capital costs for the new technology as compared to the gasoline engine would not matter as much.
Autonomous cars used for local trips would be an ideal application for getting electric cars into operation in
high numbers.
Increased use of car-sharing for local transport reduces the overall demand for vehicles which in turn reduces greenhouse gas emission for manufacturing automobiles.

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BIOGRAPHIES

Lecturer Engineering Department of MIT-WPU School of Polytechnic and Skill Development, Kothrud, Pune, Maharashtra, India. My education has been in the field of Production engineering with M.E. in Production Technology and Management.