IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

AUTONOMOUS VEHICLE IN INDIAN CONTEXT: A REVIEW

[1]Shivanshi Yadav, [2]Nagresh Kumar, [3]Vimal Kumar, [4]Devanshi Yadav
[1]Research Scholar, [2]Assistant Professor, [3]Professor, [4]Research Scholar
[1]Computer science
[1]Meerut Institute of Engineering and Technology, Meerut (UP)

Abstract: Today manned vehicles are being replaced by automated vehicles embedded with sensors and failure free hardware devices. A fully-automated vehicle should know by itself that how to detect risks on its track without a human driver's oversight. Automated vehicle are less vulnerable to crashing as compare to manned vehicles if controlled properly. In this review paper, I have introduced the framework /architecture model for automated vehicle that would be more suitable for a developing country like 'India'. Also I have mentioned the need for research in this area and have discussed some relevant survey data on automated vehicle.

***Index terms*- Automated, Autonomous vehicle, manned vehicle, driverless vehicle, elderly, Automotives.**

INTRODUCTION

A private car, or non-motorized vehicle, is self-contained vehicle which performs the necessary functions without any human interference, by using its ability to sense its environment. The autonomous vehicle uses a fully automated self-driving system which allows the vehicle to participate in its surrounding conditions that the human driver can control. There are various 5 automation levels in such vehicles which are given below:

At **Level 0**, the car has zero self-control over its operation. It is fully manage and driven by human drivers.

At **Level 1**, the ADAS vehicle (advanced driver assistance program) is present. It supports the driver in performing various functions like driving, accelerating and braking, etc.

In **Level 2**, ADAS can control the steering, acceleration and braking, etc. While the human drivers give his attention to vehicle's surrounding throughout the entire journey. The manned driver in this level performs other remaining tasks.

In **Level 3**, the ADS (advanced driving system) usually perform all the driving tasks till a particular level. While the human drive is present in order to regain the control over vehicle when asked by the ADS to do so. In the remaining cases, the human driver performs the required functions.

Finally, **Level 4** includes fully automated vehicles where ADS performs all functions in all different situations. Also it do not need any type of driving assistance from human drivers. It operates using 5G technology, allowing vehicle to communicate with robots, signs, signals, roads, other vehicles in its surrounding.

One of the latest automotive technologies used in automobiles now days is the ACC (adaptive cruise control). ACC has the capability to automatically adjust the speed of the vehicle to ensure that it maintains a safe driving distance from the other vehicles present in front of it. This function is performed on basis of the information that the ACC obtained through the sensors embedded in the vehicle. It also allows the vehicle to perform brake-like functions when it senses that it is approaching any vehicles ahead. Firstly, this information is processed and on the basis of these processing appropriate instructions are sent to the vehicle's actuators, which control various actions of the vehicle like driving, acceleration and braking which are needed here. Automatic vehicles are embedded with fully automatic speed control system having the capability to respond to signals from robots and other such non-motorized functions.

Automated vehicles have many benefits. Private car technology can offer some advantages as compared to human-powered cars. One of the biggest benefits is that they provides boost in road safety - vehicle crashes, road accidents causes more deaths every year in India as well as worldwide. Preferring automatic vehicles over human driving vehicles can reduce the number of road accidents and road injuries happing today as the software's and sensors used in such vehicles are likely to make fewer or no mistakes if we compared it to humans. Decreasing the number of accidents also result into reduction in traffic congestion, resulting as another

potential benefit for private cars and vehicles. Independent driving can also achieve this by removing human behavior that creates roadblocks, especially stop and walking traffic.

One of the major benefit of automatic driving and autonomous vehicle is that people who cannot drive - due to some issues like age and disability - can use automatic vehicles as the easiest modes of transportation.

Additional benefits come with a autonomous vehicle is the it reduces driving fatigue and allow person to be able to sleep during the night trip.

RELATED WORK

Raza (2018) Autonomous vehicles are also called as non-motorized or self-driving vehicles. Self-driving vehicles are considered unavoidable, so the requirement of certain technical and legal guidelines will be required for safe and non-controversial travel. Possible

Concerns about private vehicles should be discarded with safer policies and technologies as discussed in the paper. More expectations and topics discussed - 'private cars' will change the way people travel. Obstacles are a cause for concern but can be improved over time with information. Therefore, because of some challenges it would not be wise to discard the whole idea. The use of private vehicles is much more likely to benefit the transport industry as self-driving taxis and delivery trucks will significantly reduce manual labor.

Raviteja and Vedaraj (2020) The testing of private car technology initially started in 1920 and was controlled by radio technology. Later, the tracks began in 1950. For the past few years, modernization of automation technology was very slow and hard to be used in normal human life. The current human as well as its needs are addicted to automation and robotic technology uses such as agriculture activities, medicine field, transportation system, automotive and manufacturing industries, IT sector, etc. Level-3 autonomous vehicles are already out in the year 2020. Independent automatic vehicles requires a continuous updated data from its surrounding, so in such case, IoT and Artificial intelligence help to allocate another device information to the device. In India, a major problem is the automotive control system. Metropolitan areas only follow full road plans excluding urban and rural areas. Indian road transportation and traffic system is also hugely dependent on weather. If the weather and roads are in good condition in India only then the automatic vehicle can be functional here. Our road and highway transport is improving day by day with the continuous efforts of government which itself favoring for the introduction of automatic vehicle in the country.

Hancock *et al.* (2019) Automatic vehicles (AVs) are already roaming around the world. Key questions focus on how such technology will affect travel plans, our social environment, and the people who live in it and whether those programs should be fully implemented or remain under some form of direct human control. Most importantly, how our own traveling lifestyle will change after coming of autonomous vehicles as they will operate and follow the instruction by their own ways? How will society be kept informed of its changing capabilities, and what will be the impact of science and the interaction of scientific advances on various forms of communication in these phenomena? marine change in the way human transportation is made. Some new manufacturers consider the car to be a computer with wheels, and they have gone into business because they are computer companies. Further, many traditional producers continue with driver-focused ideas. Since the main concern is focused on end-to-end (i.e., start-to-end end-to-end) performance, the direct birth of each part of the journey can be placed under the overall purpose. Questions relating to different social conditions far exceed the algorithmic control of lateral control and length. They point to one outstanding truth: When we change the state of transportation in a proposed way, we will change the state of society itself.

Bimbraw (2015) In the present decade, we have independent electric vehicles which are powered by circuits, sensors installed on the roads. In the 1960's, autonomous vehicles with similar electronic guidance systems appeared. The 1980's started with the introduction of autonomous vehicles, which after some time itself turn into a milestone in technology and to present day we use the same or modified forms of optical and radio-guided technology. The future of autonomous vehicle is an exciting time for safe and comfortable journey. Independent vehicles have been developed from basic robotic vehicles to highly efficient and efficient vehicles. contemporary development in private cars shows the upcoming private cars to come.

Shiller and Gwo (1991) represents a way to organize the movement of private vehicles moving in common areas. This method detects the geometry and speed of the vehicle which reduces the movement time considering the dynamics of vehicles, terrain, obstacles, and surface movement. The landscape is represented by a smooth cubic B pond, and the geometric pattern consists of a B spline curve designed for the surface. This approach is further enhanced by local practice, using the appropriate movement time along the way as the cost function and B spline control points as efficiency parameters. This approach addresses automotive design, switching power, landscape, barriers, and regions with varying mobility. Examples are given to show how to plan the movement of a car that rolls over mountains, without obstacles. In the case shown, the proper timing was found to be very different from the unsafe low-distance mode, which indicates the importance of the environment and the speed of the vehicles. Avoiding obstacles has been shown by setting obstacles to block the right unrestricted local solutions. The best solution for grid search has always been found to be close to the appropriate local area, but not the size of the globe. The calculation time for full use was 1 h, spending most of the time on local operation. Calculation time can be reduced by limiting map and route adjustments, or by increasing grid adjustments and avoiding localization.

Morando *et al.* (2018) focused on to investigate the safety impacts of AV using a simulation-based security measurement approach. To date, safety results have been assessed by the number of conflicts issued to the VISSIM traffic micro simulator using the Surrogate Safety Assessment Model (SSAM). The behavior of human-powered vehicles (HVs) and AVs (automatic level level 4) is tracked within the VISSIM vehicle following the model. Security investigations were conducted for the study of two cases, namely,

the cross-sectional and surrounding intersections, under different AV penetration levels. The analysis tells that AVs enhance safety feature with higher entry levels, even in shorter routes to improve road capacity as well as reduce delays. The safety performance of AVs (automation level 4, fully automated) near signal intersection and at rotating roads was assessed by a number of potential conflicts based on collision time (TTC) and post encroachment (PET). Analysis result tells that AVs improve safety features.

Schwarting *et al.* (2018) has provided a detailed overview regarding the present condition and upcoming challenges in the field of autonomous vehicles. Recent improvement in the field of AV regarding visual, planning, and automotive decision-making capability have led to significant advancement in its operational skills, with various types of new models already running on our roads. However, challenges are still there with respect to its guaranteed efficient performance and safety under all driving conditions. For example, there is a requirement of some new planning methods providing more secure as well as reliable operation and system compliance in complex; congested environments while showing uncertain connections with other traffic participants are required. There is a huge jump in this field in the last few years, still many questions remain unanswered. The increasing popularity of data-driven algorithms in both cognitive systems and programming systems strongly needs a second phase of innovation. Authentication, safety, and awareness are essential requirements to allow the shift from display systems to autonomous vehicles ready for production in our daily lives. In addition, standalone systems that operate in complex, dynamic, and collaborative environments require artificial intelligence that adapts to unpredictable situations and reasons in real time when working with multiple traffic participants. Autonomous vehicles still need to achieve human-level fidelity while making decision, planning, and perception. But current data acquisitions about AV and their on road percentage divisions are insufficient in difficult situations, such as bad weather.

Greenblatt and Shaheen (2015) Several automobile companies along with Google is planning to roll out AVs between 2017 and 2022, with huge benefits which includes increased vehicle safety, highly efficient road use and high energy efficiency. The much-needed AV mobility can provide more transportation, land use, and environmental and social advantage often resulting in reduction of both vehicle ownership and the annual distances traveled by vehicle. In addition, shared AVs will also result into low energy consumption and GHG emissions. Some researchers also have suggested a possible move in personal transportation, with almost all autonomous vehicles over the end of a century. It will be an appealing and human lifestyle adaptable technology by the 2040s, and surely by 2050 it will dominate human transport, as mobile phones are dominating communications at present. It also provides us huge energy and environmental benefits when compared to our traditional vehicles, decreasing the burden on governmental policymakers and planners who have found the personal mobility sector difficult to manage and distinguish.

Nordhoff *et al.* (2018) Automatic vehicles contribute to environmental mobility and address the inefficiencies of modern transportation systems. However, non-driving vehicles will only be successful if they are approved by their users. Those people are more attracted to automobiles than women. But the effect of age on adoption is mixed. Young people were more receptive to automobiles than older people. In contrast, 36- to 65-year-olds were found to have a more positive attitude and a stronger motivation to use used cars than people between the ages of 18 and 35, with automatic driving features. Every person's has his own view regarding future of AVs, their travel-related knowledge development, and their attitude towards non-motorized vehicles (e.g., transport-related, symbolic, practical, and usable).

Faisal *et al.* (2019) automotive vehicles are now a burning concept with the growth in number of the smart city concept. However, legislators, district administrators, governmental policymakers and planners are prepared to manage the possible upcoming disruptions to such autonomous vehicles, which will surely replace traditional transportation system one day. The approach includes a systematic review of the available evidence to understand the power, impact, planning, and policy issues that are relate to such vehicles. The review mentions the traces of technological advances, disruptive effects of these developments, strategies for dealing with disruptions, and potential gaps in literature. This paper is creating a framework which includes the linkages between the driving associations, the implications, impacts and possible interventions, etc. It concludes by saying that there is a good need to provide autonomous vehicles for our cities, although its broad adoptions in human lifestyle may take some time. AVs represent a way to build the right urban form and advances in independent driving technology have the potential to bring smart travel to our fast-paced world; but for some the AV is a branding symbol. The biggest disruptions to AVs in our cities will be city transport, proper land utilization, rental, parking, ownership of vehicle, infrastructure condition, investment decisions, sustainability, mobility of vehicle and its safety. It is clear from this paper that preparing our cities for such AVs will be a challenge.

Meyera *et al.* (2017) the research paper shows that autonomous vehicles can create another quantum leap in reach. In addition, the spatial distribution of accessibility impacts means that such vehicles prefer the proper development of the city and can provide public transportation facility in a larger area in comparison of congested under-developed urban areas. It also states that there is a significant increase in accessibility that can be expected in private cars. However, the magnitude of the disruption that will result depends largely on whether the available energy capacity is achievable. Only in large collections, where the highest transport requirements meet the minimum road capacity, public transport will still be required. However, with the high gain of road capacity, the area, where public transport will be required, was reduced to facilities for those mergers only. With this in mind, the results of this study paint a similar picture of public utilization cases of public transport and shared vehicles than in previous studies about the cost structures of those systems. many aspects of future independent vehicles are still unclear, this study provides an initial estimate of the impact of future private car accessibility.

Collingwood (2017) AVs are computer-controlled vehicles which operate itself automatically by relying on multiple data sources, actuators, sensors which monitor the driving environment and control the performance of the vehicle. This is due to the fact that poor looks, drunkenness, poor judgment of other road users, distraction, apathy or rushing are the most common causes of collisions on

UK14 roads. Automatic vehicles will not make these errors. Therefore, a computer is a better driver than a human. It's best to keep a steady pace, keeping its "eyes" on other drivers or pedestrians and it's better at doing a quick fire fix. In addition, the computer is uninterrupted, can clearly detect cyclists and pedestrians, responds quickly to imminent danger and does not fall asleep (unless instructed) and these variables play a major role in preventing accidents. Confidentiality such as the management of confidential information and the misuse of that private information creates the focus of the paper. The analysis begins with a discussion of how automotive technology creates concerns surrounding privacy such as information management and then continues to explore the basis on which privacy expectations can be made in this context. Also, the data bank associated with automatic vehicles includes details of exactly who is boarding, where passengers were picked up and dropped off, when and which route was taken. This information is the legal (and most valuable!) Property of private car owners and operators, relying on that information to analyze how many vehicles are needed, where and how to charge or reconfigure them further, but the consequences of privacy (and cyber attacks) are visible. . while one of the great benefits of private driving is that road accidents can be eliminated, the fact is that people will die in accidents involving private cars. According to the paper the big question is debt and, in particular, where the debt should remain in the event of an accident.

Becker and Axhausen (2017) In our present life coming of autonomous vehicle promises to solve many hurdles for today's travelers and for those who work with traditional transportation system in often unpleasant and stressful situations like drivers. It will also give us an opportunity to do any other activities while traveling safely through the small traffic with the help of Vehicle-to-Vehicle and Vehicle-to-Infrastructure (1, 2) and / or special routes (3) communication should represent a better transport mode preferred for all other available routes . However, those will be in profit who do not currently have a driver's license, either because of health conditions or age. But it is also important to check the willingness of the humans to trust, pay for new services and for what purposes - and when - respondents prefer to switch from existing alternatives. Unless this technology is currently unavailable to the public and that its specific launch date is not yet clear. A pattern can be identified by reviewing the results of their published results. AV technology is very popular with young generation. In urban areas, men's as well as those who currently have a vehicle with driver development programs, tend to show interest regarding using technology.

Petit and Shladover (2014) Automotive vehicles have been one of the most important applications in the field of autonomous or intelligent transport systems (ITS) since the launch of ITS research in the mid-1980s. The separate components of automotive automotive and ITS integration have never been fully integrated, but this will be a necessary step in the near future as collaborative data exchange will provide the necessary input to improve the performance and security of automated systems. Therefore, it is important to start thinking about the cyber security consequences of automated automotive integration programs. In this paper, we investigate potential cyber attacks on automobiles, their special needs and vulnerability. The un ignorable issues in this paper is a similar analysis of private and cooperative vehicles, showing the similarities between the obstacles they face and the strategies that can be used to manage those obstacles. The vehicle must have sufficient deficiencies in any input source to allow for compatibility where one path is attacked, especially if that method involves multiple sources of information (e.g. GPS performance and co-operation), and if false response information may be very disruptive. Systems should also be designed to fail miserably in the event of a systematic attack in many ways. One should know the importance of this issue in AVs and support others to add their views about potential cyber security threats attached to automated vehicles and counter measures that can be used to overcome them safely and quickly.

Goodall (2014) A fully automatic vehicle should proceed with the decision of how to place the accident without the supervision of a manned driver. It comes under ethical decisions, especially in conditions where an automatic vehicle cannot avoid a collision. Government and media coverage often focuses on the expected safety advantages from such automation, as computers, software are expected to be more alert, accurate, précised and predictable than manned drivers. Human live loss is the only serious problems arising from automatic vehicle crashes. The first problem is debt, as it is not yet clear who will be at fault if the vehicle crashes while driving. The second problem is the automotive ability to take difficult decisions on a personal level when driving, especially just before a crash. To ensure safety, automatic vehicles should regularly check for hazards: the risk of speeding on a sharp curve, crossing the middle lane past a cyclist, by swiping to the side of a nearby car to avoid a speeding truck from closing behind. The car (or the developer in advance) has to decide how much risk he or she will receive and the nearby vehicles. If the risk is considered acceptable, it should determine how the risk can be separated between the people involved. These are ethical questions that, due to time limit during an accident, it should be determined by the vehicle independently and speedly.

Wiseman and Grinberg (2016) the use of autonomous vehicle will surely decrease the percentage of road accidents significantly. In addition, such vehicles can improve on parking issues such as the ability to park in a remote area on the outskirts of a city. These vehicles also save a lot of fuel, energy and their insurance will also be cheaper. Also, people with disabilities can benefit greatly from this technology. Another significant benefit for nation is that these AVs as private military vehicles can prevent injuries and deaths in battle. There is a need to do more research until the AVs are able to safely drive to our destination, without being involved in an accident, crash and without driving or being there at all. Where our vehicle on the scale of independence and advanced safety is is one of the most discussed questions regarding this technology? Autonomous vehicles will be a great help for people with disabilities, old age, children's, and women's of India. In addition, hardworking people or drunken people will be able to drive such a vehicle without self-driving. In addition, AVs will also take physically fit people out of the driving load and will allow them to do other activities on their trip such as work, relaxing or just enjoying the view. Another issue is air pollution that will be considered again. Such smart connections, which drive its traffic on the basis of the allocation of crossings, will significantly reduce traffic congestion and other delays. Private cars will alleviate the anxiety of busy parking systems. The overall impact of private vehicles is unknown and the

impact on other modes of operation is unclear. Also, the impact on transport infrastructure is not specified. When private cars enter the transportation market, more details will be available and this information will conduct more in-depth research. These vehicles are expected to travel on the same road and have the same road signs that we are currently familiar with. These cars can be driven by children or other people who do not know. In addition, they will be driven in a way that is more efficient than a standard driver. Concerns about parking will be greatly affected by private vehicles as private cars can park in a remote area and in the appropriate parking lot. There are few other related concerns such as a huge population of professional drivers who will lose their jobs creating more unemployment in India and the potential congestion followed by other vehicles which are traveling empty or traveling with children; however with properly managed arrangements switching to autonomous vehicles can be done smoothly and efficiently.

Ahuja *et al.* (2015) an autonomous vehicle is able to sense its environment and road transportation condition without any human input. Robotic cars exist mainly as models and display systems. They capture their environment through technologies like radar, GPS, and computer vision. To come up with its surroundings map an AV uses equipment such as: Radar Sensors, Cameras (used for routing and support but as image processing software improves, the value of ship cameras will increase, image - processing software can now detect road signs and lights, lanes, etc. , GPS Units (Global positioning system used to detect vehicle's location by satellite input), Accelerometer (Vehicle navigation assistance if poor signal is detected from GPS devices), Ultrasound Sensor (Currently ultrasound sensors are widely used to detect obstacles in the front and rear of the vehicle automatically. Wheel Sensor are also used for stabilization and braking system. Wheel sensors also keep track of the vehicle's location when the GPS system is temporarily unavailable due to negative signals. Light Detection and Hold (LIDAR) is also there to always take precise distance measurements. Google's LIDAR system is embedded with approx 64 infrared sensors mounted on the car, the Inertial Measurement Unit (IMU) is used for sensing vehicle movement and movement and contains high precision 3-axis accelerometer and angle rate sensors to measure roll, pitch levels and angle. Today's driverless vehicles depend on GPS systems and cameras to drive on the road without human interference.

Sousa *et al.* (2018) discusses private vehicles and their impact on the economic, energy, security, traffic, and land use levels. The automotive industry at present is facing two huge changes, which will challenge the modern societies as well as the future of the AV industry. The first change is the energy challenge, caused by sustainable and environmental concerns, which require the industry to develop the power to replace the present condition, probably dominated by the Internal Combustion Engine (ICE). The second change is related to the challenge of independent driving system. AVs will bring, sooner or later, a huge change in the transport paradigm in India as well as in entire world. Whether this change will come from widespread adherence to new models for the use of new vehicles, efficient traffic, power installations, other features or any previous integration is still unclear till date. And this change will be visible on cities, especially if one thinks that cities are changing because of many development factors. The study summarizes the potential impact of AVs and modern technology on educational research in this regard. It also said that AVs could make other types of vehicles more affordable, perhaps large enough to be able to shape the city and traffic

Litman (2020) the impact of private vehicles (also called self-driving, non-driving or robot), and their impacts on travel planning. It investigates how fast those vehicles can grow and be used based on the experience of past automotive technology; their potential benefits and costs; how they will affect the tourism industry; and their implications for planning decisions such as full road, parking and public transportation. Driving on public roads is complicated by frequent contact with others, unexpected animals, pedestrians, cyclists, and motorists. Significant progress is needed before these vehicles can operate independently, reliably on mixed urban vehicles, heavy rain and snow, unpaved roads, and where wireless access is unsupportable as well as unreliable. Years of testing and government law enforcement will be required before it can be commercially available in most areas. Automotive technology is taking longer to enter the market than many other sectors. But now it's a high time to take essential steps to promote this technology in country like India. It may take a decade for AVs to control the purchase, preference for new vehicles and troops, and even some motorists may refuse to use them.

Guler *et al.* (2014) proposes an algorithm for two-way one considering that only a certain percentage of vehicles are equipped with this technology. The algorithm calculates the different sequence of vehicles exiting at a crossroads to reduce objective activity. The advantages of plunging (multi-sequence vehicles) and signal flexibility (adaptability) are considered. The aim is to gain an understanding of the cost (depending on the cost savings) of using connected car technology to control the merger. Using data from connected vehicles to better fit the road signal has proven to be extremely important. An increase in the entry rate from 0% to 60% can significantly reduce the average delay (in the most demanding cases a decrease of up to 60% can be observed). The results of this project demonstrate the promise of reducing traffic congestion by providing traffic congestion. Although the algorithms were not directly matched with the performance indicators, a case with an entry rate of 0% was considered to be a representative of this. Currently, the authors are working to integrate the algorithm with real-time control with the help of simulation software to have realistic driver behavior and compare it with other road signal control strategies. The algorithm has improved the look at the split cross. Additional work is being done to develop algorithms that can provide multi-intersection intersections. The results of the algorithm described in this paper show that the green times in each method are always the same throughout the simulation process, leading to normal rotation times.

EXISTING MODELS

Delhi Metro Rail Corporation (DMRC) is an elite league of 7 percent of global networks that can operate without drivers. India's first non-motorized railway operations in a 38-kilometer long stretch. The driverless train is a major technology in the Indian context. It offers more reliability due to reduced human intervention as they are equipped with hi-tech cameras and hearing aids to ensure the

safety of passengers. The operation of these trains is a major technological milestone for the DMRC and the country. This train travels at a normal speed, which are a few inches higher than those driven by the average driver (about 35 kmph). It is equipped with a number of advanced features that make travel faster and smoother.

Speaking of the world, then we find out that in the USA the partner company of Google, Waymo is operating a bulk of automotive vehicles that is running in many places with the name "Waymo One" with the help of mapping. In October 2020, the company also expanded their service to the public, and at present is the only running self-driving service that operates without vehicle safety drivers. Waymo has also developed driving technology that can be further use in other vehicles around the world. The enthusiasm surrounding non-motorized vehicles has grown rapidly over the past few years, with many large technology companies supporting the idea.

However, Google's Waymo developing in the market for a driver-friendly car[Fig:1] worldwide is a major step in the field of unmanned vehicles. The company, along with several others in the technology and automotive industries, bet that non-motorized vehicles will soon change the way we travel. Among the major changes, the safest roads, the smallest fossil fuels, and the lower travel costs will also be the marking point.

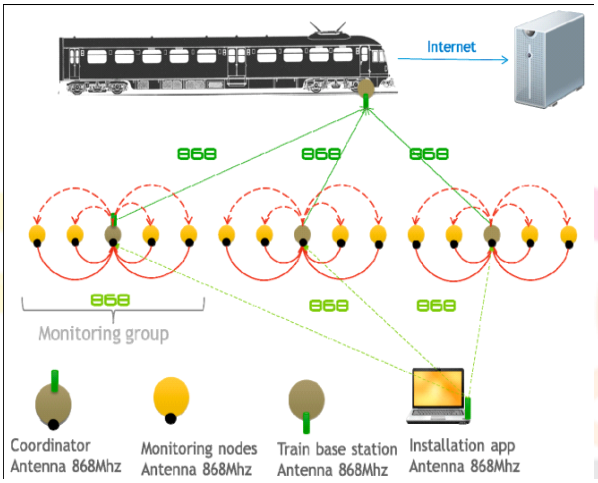

Fig: 2 architecture of sensor embedded railway station for automated vehicle.

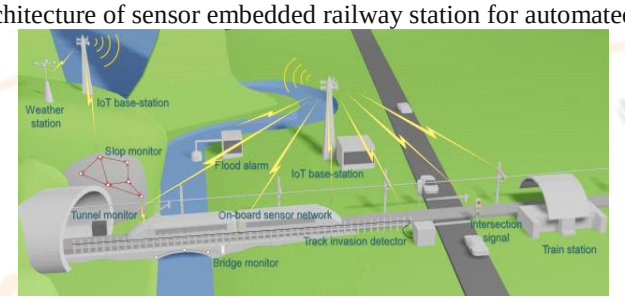

Fig: 3 sensor embedded railway station framework for automated vehicle.

Figure 2 and 3 shows the pre existing framework models with respect to AVs. No doubt that these models are beneficial for countries like USA, UK with fully developed on-road infrastructure. These models are suitable for areas with less population where there is less or no intrusion of any kind by animal as well as human near the vehicle track. But India is an over populated country with more the 135 billion population. Also, most Indian citizens are unknown with the traffic rules mentioned in our constitution. So in this paper, a new framework model is being proposed for the autonomous vehicle that can be best fitted to a developing country like India.

ANALYSIS

The automotive industry is constantly evolving with new technologies to increase the management and efficiency of the vehicle being developed and used annually [1]. The most anticipated and talked about topic - 'private cars' will change the way people travel. It is very interested in private car technology and is waiting to get ready to go on AVs. But in India, the main problem is the traffic control system. Metropolitan areas only follow full road plans [2]. We are now seeing an important transition period in which effective control of a vehicle is taken from a human driver and placed under computer systems in the aircraft itself. When we change the state of transport in the proposed way, we will change the state of society itself. Whether we are ready to take such an action for evolution remains to be seen [3]. Most vehicles are expected to be completely independent by 2035, according to official forecasts as mentioned earlier [4]. Independent vehicle systems still need to achieve human-level fidelity while decision-making, planning, giving instructions, perception, and current acquisitions and percentage divisions are insufficient in difficult situations, such as bad weather. Ultimately, we conclude that AVs will provide much-needed transportation for anyone, anywhere, anytime. To achieve this vision, further improvements are needed in the management of large vessels with a stochastic route, internet performance, and quality of service tied. If we can overcome these challenges, private cars will have a very positive impact on our lives [8]. This paper has reviewed the historical precedents, modern developments and the predictable future of powerful and completely independent vehicles for human use. The recent crash of Tesla auto-pilot proves that AV's core operations need some significant improvements, leaving a combination of all AV capabilities still too far. The AV-based community needs a different perspective. Population will need time to

adapt it their lifestyle, and it is possible that some die-hards will never give up being in the realm. However, as large automobile companies are committed to the new phase development of AV, it is only a matter of time before some of the above-mentioned impacts are revealed. More predictions about the future can be found in the latest work (Litman, 2015). And it seems that men are more attracted to automobiles than to any other thing. In coming future, people surely will be comfortable with the idea of self-driving cars, while passengers engage in other activities such as texting, talking, watching TV, or reading; cars can even be converted between wealthy users into a "mobile home", offering a place to work, food, entertainment, or sleep activities while on the go, even if the decline is from their largest size [8].

Table-1: Accident caused by manned/ autonomous vehicle (2015-19)

S.No.	Year	Road accidents (manned vehicle)	Road accidents (autonomous vehicle)
1.	2015	501432	8
2.	2016	480652	15
3.	2017	464910	1
4.	2018	467044	3
5.	2019	449002	0

Table-2: People preferring car connectivity in automated vehicle [21]

S.No.	Country	Preferring car connectivity (automated vehicle)
1.	India	80
2.	China	76
3.	Japan	49
4.	USA	46
5.	Germany	36

Table-3:Projected autonomous vehicle registration [22]

S.No.	Year	Projected Registration
1.	2022	0.17
2.	2023	0.29
3.	2024	0.49
4.	2025	0.84
5	2026	1.7
6	2027	3
7	2028	5
8.	2029	8
9.	2030	12

Table:5 Major impact of autonomous vehicle in different sectors[23]

Sector	Impact
Living arrangement	The influence on which people choose to live (travel will be more acceptable because the time usually spent driving can be spent on other productive activities such as reading, sleeping, or just relaxing), increases the choice of independence. (Elderly, disabled, and ill).
Job sector	Reduction of buses and train drivers, civil servants working in public order and traffic departments, rising in the recruitment of scientists, cleaners (maintaining proper hygiene in communal areas.)

Business	Huge boost in E-commerce sector, local businesses getting advantage of localized services to generate personal and localized advertising.
Road accidents	Reduction in road accidents.
Health system	Saving approx 35,000 lives but will lead to shortage of donated organs.
Cities	Change the way cities are built, the laws that guide them, the taxes that are set. Reducing brakes and acceleration, changing the way their robots work, changes in road construction, there is less need for higher investment in speed cameras, reduction in revenue from traffic fines.

PROPSED FRAMEWORK/ARCHITECTURE FOR DRIVERLESS VEHICLE

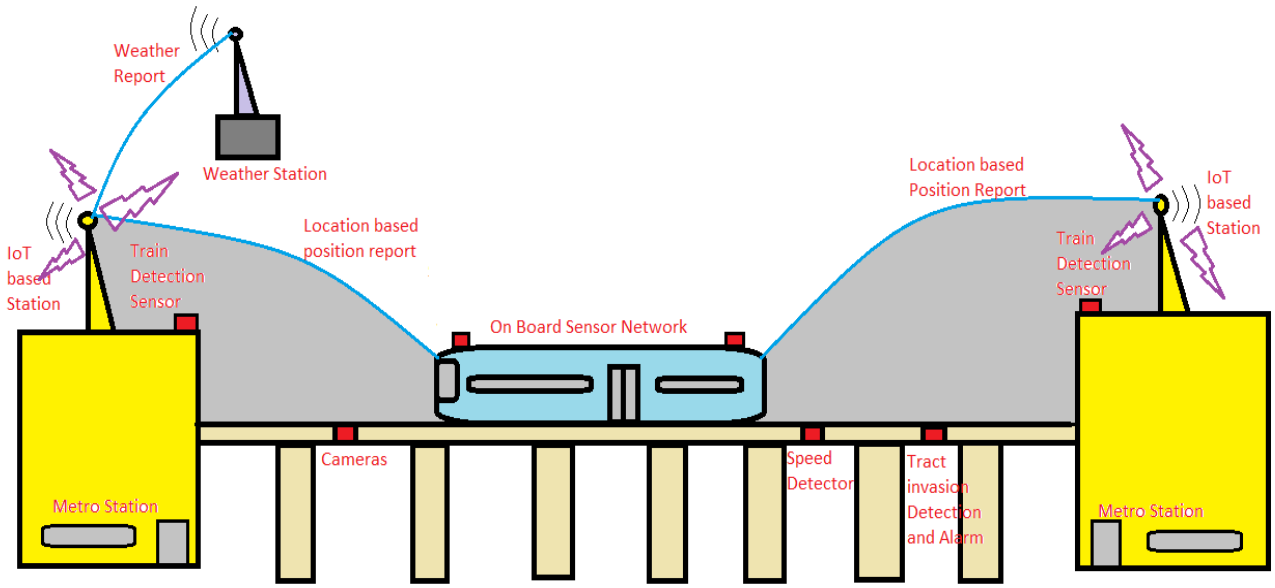

Fig: 4 Proposed Framework/Architecture of Driverless Vehicle in context of India.

In this above proposed framework, the working model of Autonomous vehicle is given in context of India. Since there is a huge traffic, congestion on the roads of metropolitan cities in India so the autonomous vehicle will be running on bridges pillared over the existing roads. The bridge will be connected to many metro stations coming in the way. Each metro station will be embedded with different IoT based station that will sense the vehicle track, AV, its surroundings, etc and will communicate with vehicle accordingly. Each IoT based station will also be connected to the weather forecast station to get the updated weather information. The autonomous vehicle running on the track will be embedded with on board sensor network to continuously sense its environment and act accordingly. The vehicle will also be in continuous connection with those 2 metro stations between which it's running. On the other hand, the vehicle track will be fully embedded with cameras, speed detector and controller, Track Invasion Detection and Alarm System sensing each and every action on AV running on track. There sensors will also be connected to 2 metro stations nearest to it giving an updated data about the AV continuously without any delay.

In context of India, this autonomous vehicle will be of greater significance as compare to our existing traditional transportation system. The very first benefit of it is that people of any age can have access to it at any time according to their need. Since stations of such trains will be available in all remote areas of the city automatically making the travel smoother and easy to reach. The vehicle, track and station will be fully embedded with sensors making the travel totally automotive and safer. This concept will also be beneficial for elderly, children's, women's and people with disabilities incapable of driving vehicle. The autonomous vehicle will also be environment friendly which will operate by electricity only. We can call it as green autonomous vehicle supporting Global

Sustainable Environment Plan of Government of India. If we focus over its framework then we find that these vehicles will be running on the bridges just above the road and pedestrian avoiding the on road traffic and congestion, resulting into decreased traveling time.

India is a developing nation with undergoing many changes at various levels. The transportation and road infrastructure of India is still under-developed and need many changes which can be a hurdle if we launch the AVs directly on-road. There are few challenges also that can create obstacles in the proper functioning of this vehicle like improper weather conditions, failure of sensor, any technical issue, etc. But as we know that tomorrow never comes so it's a high time for the development og autonomous vehicle in India to in order to replace the existing old orthodox transportation system. In 2013, GoI has also launch the National Electric Mobility Mission Plan aimed with 30% e-mobility by 2030. Thus, the launch of this autonomous vehicle in India can give a great boost to in Indian transportation system as well as Indian economy.

CONCLUSION

Automatic vehicles are very helpful in human life and are highly developed in the environment around us. Or sometimes they will crash when they are not treated properly. Even easy travel will require the car to determine whether its and other hazards are acceptable. These statistics, acceptance and risk classification can be made easier, and human drivers will not be able to oversee these decisions. Automatic cars are able to make better decisions independently compared to hand-operated vehicles. It can be done with pre-specified instructions, machine learning method, or a combination of the two. Today the ethical and ethical modeling fields are also growing exponentially. And the infrastructure that supports automatic vehicles is also developing very fast, but there is still a lot of work to be done. This review is intended as a guide for those who want to use the concept of automotive vehicle in India but are faced with the challenge of implementing, conveying key concepts, and provide useful research indicators in related fields.

REFRENCES

[1] Raza, M. 2018. Autonomous Vehicles: Levels, Technologies, Impacts and Concerns. *International Journal of Applied Engineering Research*, 13(16): 12710-12714.

[2] Raviteja, T. and Vedaraj, R.I.S 2020. An introduction of autonomous vehicles and a brief survey. *Journal of Critical Reviews*, 7(13): 196-202.

[3] Hancock, P. A., Nourbakhsh, I. and Stewart, J. 2019. On the future of transportation in an era of automated and autonomous vehicles. *Proceedings of the National Academy of Sciences*, 116(16): 7684-7691.

[4] Bimbraw, K. 2015. Autonomous cars: Past, present and future a review of the developments in the last century, the present scenario and the expected future of autonomous vehicle technology. IEEE. In *2015 12th international conference on informatics in control, automation and robotics (ICINCO)*. 1: 191-198.

[5] Shiller, Z. and Gwo, Y. R. 1991. Dynamic motion planning of autonomous vehicles. IEEE Transactions on Robotics and Automation, 7(2): 241-249.

[6] Morando, M. M., Tian, Q., Truong, L. T., and Vu, H. L. 2018. Studying the safety impact of autonomous vehicles using simulation-based surrogate safety measures. *Journal of advanced transportation* 2(3):21-29.

[7] Schwarting, W., Alonso-Mora, J., and Rus, D. 2018. Planning and decision-making for autonomous vehicles. *Annual Review of Control, Robotics, and Autonomous Systems*.

[8] Greenblatt, J. B. and Shaheen, S. 2015. Automated vehicles, on-demand mobility, and environmental impacts. *Current sustainable/renewable energy reports*, *2*(3): 74-81.

[9] Nordhoff, S., De Winter, J., Kyriakidis, M., Van Arem, B. and Happee, R. 2018. Acceptance of driverless vehicles: Results from a large cross-national questionnaire study. *Journal of Advanced Transportation*.

[10] Faisal, A., Kamruzzaman, M., Yigitcanlar, T. and Currie, G. 2019. Understanding autonomous vehicles. *Journal of transport and land use*, *12*(1): 45-72.

[11] Meyer, J., Becker, H., Bösch, P. M., and Axhausen, K. W. 2017. Autonomous vehicles: The next jump in accessibilities. *Research in transportation economics*, *62*: 80-91.

[12] Collingwood, L. 2017. Privacy implications and liability issues of autonomous vehicles. *Information & Communications Technology Law*, *26*(1): 32-45.

[13] Becker, F. and Axhausen, K. W. 2017. Literature review on surveys investigating the acceptance of automated vehicles. *Transportation*, *44*(6): 1293-1306.

[14] Petit, J. and Shladover, S. E. 2014. Potential cyberattacks on automated vehicles. *IEEE Transactions on Intelligent transportation systems*, *16*(2): 546-556.

[15] Goodall, N. J. 2014. Machine ethics and automated vehicles. In *Road vehicle automation* : 93-102. Springer, Cham.

[16] Wiseman, Y. and Grinberg, I. 2016. Autonomous vehicles should not collide carelessly. *Advanced Science and Technology Letters*, *133*, 223-228.

[17] Ahuja, A., Gautam, A. and Sharma, N. 2015. Driverless Vehicles: Future Outlook on Intelligent Transportation. *Int. Journal of Engineering Research and Applications*, *5*(2): 92-96.

[18] Sousa, N., Almeida, A., Coutinho-Rodrigues, J. and Natividade-Jesus, E. 2018, March. Dawn of autonomous vehicles: review and challenges ahead. In *Proceedings of the Institution of Civil Engineers-Municipal Engineer* 171(1): 3-14.

[19] Litman, T. 2020. Autonomous vehicle implementation predictions: Implications for transport planning.

[20] Guler, S. I., Menendez, M. and Meier, L. 2014. Using connected vehicle technology to improve the efficiency of intersections. *Transportation Research Part C: Emerging Technologies*, *46*, 121-131.

[21] Around 80% of Indian buyers prefer vehicle connectivity. https://auto.economictimes.indiatimes.com/news/auto-technology/around-80-of-indian-buyers-prefer-vehicle-connectivity/73418411
Retrieved on date 17/04/2021.

[22] 3 types of autonomous vehicle sensors in self-driving car.
https://www.itransition.com/blog/autonomous-vehicle-sensors
Retrieved on date 18/04/2021
[23] 6 Ways autonomous vehicle will impact lives as we know it
https://roboticsandautomationnews.com/2020/06/22/6-ways-autonomous-vehicles-will-impact-life-as-we-know-it/33326
Retrieved on date 18/04/2021.
[24]
https://www.google.com/search?q=sensor+embeded+station+architecture+for+automated+trains&tbm=isch&ved=2ahUKEwir657y3KDxAhXrn0sFHWlIB6wQ2-cCegQIABAA&oq=sensor+embeded+station+architecture+for+automated+trains&gs_lcp=CgNpbWcQA1C4hwxYo9IMYPbZDGgAcAB4AIABuwKIAeAXkgEIMC4xMC40LjGYAQCgAQGqAQtnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=GVTMYOv6NOu_rtoP6ZCd4Ao&bih=474&biw=1094&rlz=1C1UEAD_enIN946IN946
Retrieved on date 9/06/2021
[25] https://www.mdpi.com/1424-8220/17/6/1457/htm
Retrieved on date 16/06/2021
[26] https://www.sciencedirect.com/science/article/pii/B9780128093931000143
Retrieved on date 16/06/2021
[27] https://www.google.com/search?q=delhi+metro+&rlz=1C1UEAD_enIN946IN946&sxsrf=ALeKk02taI_L9ZhRdsdQtj-iY9nxlGdVpQ%3A1624007778975&ei=YmTMYOD6OsCM4-EP18KXkAo&oq=delhi+metro+&gs_lcp=Cgdnd3Mtd2l6EAMyBAgjECcyBQgAELEDMgUIABCRAjIICAAQsQMQgwEyAggAMggIABCxAxCRAjIFCAAQsQMyCwgAELEDEIMBEJECMgIIADIFCAAQyQM6BwgAEEcQsAM6BwgAELADEEM6CggAEIcCELEDEBRQvLwBWPjBAWDOiwJoAXACeACAAe0CiAH0CJIBBzAuMy4xLjGYAQCgAQGqAQdnd3Mtd2l6yAEKwAEB&sclient=gws-wiz&ved=0ahUKEwjgs5y27KDxAhVAxjgGHVfhBaIQ4dUDCA4&uact=5
Retrieved on date 5/06/2021
[28] https://en.wikipedia.org/wiki/Delhi_Metro
Retrieved on date 5/06/2021