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ARTIFICAL INTELLIGENCE (A.I) BASED HEAVY VEHICLES

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Abstract

This paper will cover the conversion of normal conventional cars into the autonomous car (Driverless car), problems associated with it, objectives, requirements and the expected outcome of this step. It will also cover the standards and give the critical comparison between conventional and driverless cars. This AI based car will cause a huge change in people's life, we will research and analyse the various impacts on society, legal and ethical challenges, and importantly environmental constraints. We will also research on the previous similar technologies and take a look the way researchers are working to make this technology even better in the future.

Introduction

As the World is progressing, scientists and researchers are struggling to take the human life in more comfort zone. People around the World are now quite much enthusiastic about the launch of autonomous cars. The speciality of this car is its ability to perceive its environment using the modern form of AI, and take decisions without the assistance of any driver. In other words, these cars are equipped with special sensors, processors and another database which is responsible for the operation of this car and doesn't require any driver. It navigates itself following up to the destination point requested by users. Indeed, it is the big revolution in the field of robotics, which is contributing a lot to make this planet safer place. On a technical basis, this car is designed based on the various areas of engineering which includes electrical, mechanical, computer sciences and control engineering etc. [1]. Major progression in the autonomous car has started when the Mercedes Benz has launched the vision guided the car in 1980 after this invention it has stared a huge focus on the areas of GPS system, radar etc. This has also resulted in the development of the adaptive steer control, power steering and other things that are involved in the humanitarian assistance as well. And now the research is going on to introduce the World with the driverless car which could be much safer, efficient and reliable for the users. Road accidents are one of the major cause of death, as according to report by Deshpande et al that nearly 3000

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people died daily because of road accidents, among which half of them are not in the car, other than that it has also been reported that if some safety measures are not taken this will grow up to 2.4 million a year making the 5th largest cause of death in the World [1]. This number can be greatly reduced by putting autonomous cars into action which are far more reliable and react swiftly than humans. It will also cause reduction in the traffic congestion, as the efficiency of autonomous car makes it reliable in a way of keeping very small gaps between vehicles, and its outstanding management of speed and time. Following the navigation track without considering any other distraction makes it friendlier than the conventional cars operated by drivers.

Historical Aspects

The invention of the real autonomous car goes back to 1926 when the radio the control car was introduced by the Houdini radio control in NYC. It had an antenna which was responsible for transmitting the signal and controlled by another car following it, and a motor connected to the antenna was responsible for car operation. This concept was improved by the scientists of Nebraska in 1958, when they laid circuit down under the highways which were a source of detection for the autonomous car about the availability of other car and even guide it for steering control, acceleration and break. [2] In 1960, transport and road research laboratory in the UK has tested driverless car, which was based on the magnetic cables that were laid under the roads. The driverless was tested at the speed of 130 km/h without any change in speed and ignoring the weather conditions, it resulted in far more effective performance than the human control [3]. By the time of 1980s Germany has succeeded in designing the Mercedes-Benz Robotic car based on the vision-guided, and it could go up to the speed of 63km/h without traffic. The best technology in this area was used by the US when they launched autonomous land vehicle (ALV), where they were based on the computer vision and based on the LINDR and autonomous control the robotic car could go up to the speed of 36km/h [4] [5] [6], MercedesBenz autonomous car by Discmans' covered the journey of around 1,590 km from Germany to Denmark by using the special computer vision, microcontrollers and circuit design to act swiftly in real time. Throughout the journey, it was able to achieve the speed of 175km/h, and it performed a number of manoeuvres in a busy traffic to overtake the other car. [7] An ARGO project launched by the University of Parma in 1996, in which the car was followed according to the painted lines on the highways. It was tested for the distance of around 1,900 km over the speed of 90km/h in Italy, and over 96% of its journey, it was operated fully autonomous. It was based on the stereoscopic vision and occupy two video cameras to understand the surroundings. [8] By 2000 autonomous public transport system started in Netherlands which is named as PAKSHUFFLE. . By the course of time, several attempts were made, and all the new

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modified forms are always better than the existing ones and even currently the work is still in progress to use this system in a better format in the future.

Fully Self-Driving Automation

The AI-based specialised cars can perform all of its trip without any occupant, and it is more considerate for the people who are not able to drive or may be due to other factors unable to cope with driving. Although engineers are putting lot more effort to make it as accurate as possible, this technology doesn't give that performance so that it can be trusted blinded to put it on the road. Google is quite a confident to commercially launch these cars by the time of 2018. [13] The survey has been done by the Cisco, the major objective of this survey was to figure out the people's confidence of adopting these autonomous cars. They included around 1500 people from 10 different countries having a long-term driving experience, and they figure out the report which suggested that half of the consumers in the World will soon trust these autonomous cars.

Challenges involved with Autonomous Cars

Without any doubt, it is clear the various advantages of this driverless car like giving the source of mobility for non-drivers and decreased the driving stress for the driver, but along with these useful effects, there are numbers of challenges and difficulties that are involved in the implementation of this technology. Following are some of the major issues associated with the driverless cars:

• Cost Various cars manufacturers had to spend a huge amount of money for designing these autonomous vehicles. The example Google can be considered where they are paying around $80,000 for one of their AV model, which is totally unaffordable by the ordinary company or the person. According to the future predictions, it is estimated that this price will come down to the half, which is still more to be afforded. According to the recent survey done by the JD power, which concluded that in the future 37% of the people will choose autonomous car as their next vehicle [13]

• Infrastructure Although many big companies like BMW, Audi, Nissan etc has done a commitment to introduce driverless car, the infrastructure like roads is not up to date to that level where these cars could be compromised to launch. According to one report, it will take another 10-15 years to develop a certain type of infrastructure. Companies are really focussing to invest such a big amount with something in return [16]. Figure 5: Expected release of Autonomous cars

• Replacing Conventional Cars This is one of the biggest challenges which is being faced by the experts, replacing old conventional car would be required to increase the efficiency of the autonomous cars. If the old cars are left over under the same platform then this may lead to

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unpredictable results for the autonomous car and compromises the security during its interaction with the other cars.

• Security Concerns Security and privacy are always being the biggest issue associated with the electronic system. Autonomous cars are based on the AI system, where it also requires a source of Internet for managing and information exchange, and this is the compromise medium which can be abused by the hackers. The second major concern is the involvement of terrorist activity where this platform of the driverless car can give a favourable place where they can perform their suicide mission. And as these car is depending on GPS system, so anyone can get itself into it to use it for the bad purpose .

Ethical Issues with Driverless car

There are many ethical issues which can be raised due to the implementation of these cars. One of the major issues is the unemployment for the drivers. The implementation will cause the replacing of all the manual procedures of driving which specifically includes for taxis, trucking etc, and it is the source of ultimate livelihood for millions of peoples around the World, and this source of earning would be in serious risk as the autonomous cars will take over all the driving system, and there will be no longer need of human drivers. As this technology is depending on the sensors, where stereo cameras are one of them. These cameras continuous record the video and keep it in database for future perception and learning, but on the other hand these recording can be used by the owner or anyone else for bad purpose, as the recorded videos are not secure, and it includes the pictures of other vehicles detail along with the images of people around which is quite unethical. The efficiency of the autonomous car could bring a good change in people perception of buying such an efficient car. This will cause the conversion of the conventional car into the autonomous car very quickly. Meanwhile, this will cause a huge loss to the manufacturers of conventional cars. According to one of the report, the overall business involving conventional car will come down 37%, and this trend can further go down in the future when more awareness will be spread among the people about the advantages of adopting this AI-based technology . So, the booming of autonomous cars is quite an unethical approach for the other companies based on the conventional cars. Standard and Regulation Although this technology of autonomous cars is not yet implemented on the commercial basis, there is a number of rules and regulations that are required to be adopted before getting on with autonomous cars. And these standards must be official and strictly implemented not just by the user of these cars but also on the automobile companies that are implementing this technology. Following are some of the rules and standard proposed by the US:

• Nevada (NRS 482.A and NAC 482.A) This law was approved in June 2011 and later revised on July 2013. According to this

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law, to get the certification for using this technology must have the expertise of using this technology and pay a fee of $300 non-refundable and shoe the cash deposit in the bond of worth $500,000. Other than that applicant must pay $100 nonrefundable fee and surety bond of $1 million to $3 million depending on the number of AVs.[23]

• Florida (Fla. Stat. Title XXIII, Ch. 319, S 145) It was proposed in April 2012. It required the applicants to submit a report, which must fulfil all the safety requirements for autonomous cars and along with that applicant must have the surety bond or self-insurance accepted for the worth of $5 million dollars.[21]

• California (Cal. Veh. Code, Division 16.6) It was passed on September 2012 which was intended for operation and testing of the autonomous vehicle. Expertise and well safety information must be fulfilled by the applicant and this law was later revised in 2015. Similarly, it also requires the applicants to show the insurance or surety bond of $5 million dollars. A similar type of standards is adopted by Washington, D.C (L19-0278) in January 2013.[22] Environmental Impact The practical implementation of the autonomous car on the commercial basis will bring a huge impact on the environment. These cars are designed in a way that they are environmental friendly in many aspects. AIbased cars planned their journey by keeping in consideration all the aspects like shortest path to the destination and stay restricted to the lane. This will result in the less consumption of fuel and ultimately less emission of carbon into the atmosphere. The same concept is applied to the feature of accuracy followed by these cars. Precision and accuracy based on the AI avoid the traffic congestion. For example, when this car is parked in a lane for a traffic signal, it will keep a very small distance between the other cars in a lane. Thus, following this algorithm makes it more accurate in terms of its physical location, and this feature causes the positive impact on the environment. The impact on the environment by these autonomous cars were proved when one of the autonomous car manufactured by VisLab named it BRAiVE was tested to drive in the downtown of Parma in July 2013. And the results were totally tremendous, the car successfully went through all the hurdles like narrow roads, rural areas, traffic signs etc and the accuracy in terms of time and fuel consumption was found to be more environmentally friendly than the conventional cars driven by the human [8]

Short-term and Long-Term Impacts

Autonomous vehicles can bring a huge change in the society and that changes are not just limited to the humans but also on the other areas which make it a more favourable way of transportation. This technology is still at its beginning level and there is a lot to come up in the future. So, the predictions justify a number of impacts which could be short-term and longterm. The technology of these cars is very

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expensive, initially from its launch there won't be a large number of people to buy these cars because of it's cost. As the Google has launched the AI based AV module for $80,000 and this cost is predicted to come down gradually over the period. People might get frightened initially to ride on it or even to encounter it by the roads and the payment. But this fear can be abolished if the standards and rules for autonomous cars are strictly obeyed. There will be a big contradiction between the conventional and autonomous cars, and its concept will gradually spread in the society. Other terrorist and security threats will always be the biggest challenge and short-term impact can be disastrous. Figure 6: Stages of Autonomous car The long-term impact of this technology could result in the complete conversion of conventional cars into autonomous cars. As the time will pass, people will start getting awareness about these cars and take a chance to adopt them, and if it satisfied them with all of their needs both for driver and non-drivers, it can revolutionise the World. According to one of the predictions by the expert states that by 2050, half of the World will already adopt this technology and the quantity will keep increasing. Work is still underway and the pace of progression in AI will make this technology more secure than ever before.[18] Debating Issues In one way where this technology is bringing a positive change, on the other sides there are few issues associated with it, which makes the expert recognise them and take the decision to be fair for everyone. Autonomous vehicles can be the best source for non-drivers or disable people to enjoy the ride in their own car without any driver, which is cost effective as well. But on the other hand, it is taking away the source of livelihood for millions of other peoples that are relying on driving. GPS and another AI-based system will make this technology more secure and make it independent to operate just with the command by the users of the destination. This AI-based system is based on the Internet and this medium of Internet compromise the security of the vehicle which includes the controlling by an unauthorised person or hacks the system to get the location and other details of the owner and the car [18]. Safety of the passengers and the pedestrians is also one of the big dilemmas of these autonomous cars. No doubt the accuracy and the precision of these cars are incredible, but it must be kept in mind we are relying on the technology which is totally based on AI-based sensors. In exceptional cases, if autonomous car is caught in an accident by the other conventional car and this may lead to hardware disruption of the car and it can spoil or damage sensors as well which can dramatically affect its operation, now this situation creates a big risk for the passenger and the other pedestrians that are travelling along by the road. So, there are still many things that are required for these autonomous cars to make it more secure and friendly for the people. Legal Issues There is a number of legal barriers to the implementation of autonomous cars, mostly it is concerned about the accidents that can

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happen. In 2016, a guy was killed in an accident caused by the fault in Tesla's autopilot when it failed to recognise the truck turning the car. Later it has been reported that deceased guy's family hired experts and lawyers for litigation of product defect (19). So, it's a big legal issue in case of any happening of an accident if the owner of the car is prosecuted or the manufacturer of the car. Another legal issue of the autonomous car is the responsibility of insurance, as it is not being driven by the driver or owner, so the third-party liability consideration is the big question. In the UK, 11 prominent insurance companies including Arriva and Direct line are working on a common platform to conclude a framework for autonomous car insurance policy. According to some of them, compulsory insurance must cover product liability while the other says it must be self-insured [19]. So, there is a number of legal constraints that are required to be considered and hopefully as this technology will get more common, it will decrease these kinds of issues.

Conclusion

The vision-guided autonomous car developed by the Mercedes Benz gave a new dimension to this technology and opened doors for the research work. According to Official report, there will be quite a large number of autonomous cars that will be launched by 2020, which will be partial as well the fully autonomous. [13] And by 2035 most of the car around will be autonomous according to the predictions. It is very important that automobile companies put all their effort to make it as secure as possible because any accident caused by these vehicles can disrupt all the industry. But indeed, this technology can play an integral part as the source of transportation for public and military, in the various search operation and use for accessing certain location which is rather a risk for the human drivers [20]. The autonomous car can bring a great revolution in the World of auto motors. There are many firms and companies that are working on this technology to make it even better and secure. Many big investments are carrying out in the United States where they are trying to create a smooth platform for these autonomous cars as they require special roads and areas, but work is being done so that even we could use these vehicles in all various platforms and other uneven roads and places. This technology is still at its beginning, it might take a while for people to develop a trust for this technology and adopt it. A number of security threats and concerns are on the way, but it won't last forever.

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