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A Review Paper on Development of e-Vehicles

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Abstract: In this paper, we present a detailed chronological analysis of the achievements in autonomous automation, which is an area of interest for researchers. This paper can be useful for understanding the trends in autonomous vehicletechnology in the past, present, and future. The technology of autonomous vehicles has drastically changed since the 1920s, when radio controlled vehicles first appeared. Electric cars powered by embedded circuits on the road became fairly autonomous in the next few decades. By the 1960s, autonomous cars had similar electronic guide systems. The 1980s saw the introduction of vision guided autonomous vehicles, a major milestone in technology that we continue to use today. In modern cars, semi-autonomous features such as lane keeping,automatic braking, and adaptive cruise control are based on these systems. An extensive network of vision-guided systems is the future of autonomous vehicles. It is predicted that the majority of companieswill launch fully autonomous vehicles by the turn of the century. We are entering an era of safe, comfortable, and efficient transportation with autonomous vehicles.

Keywords: Algorithm, Intelligent Transportation, Automotive Radar, Automation system, Autonomous Car, Autonomous Vehicle

I. INTRODUCTION

Customers all across the world are excited about the introduction of autonomous vehicles for public use. An autonomous vehicle is one that can run unsupervised and without human interference. The first radio-controlled car inthe world, the Linriccan Wonder, is where the history of autonomous vehicles starts in 1926. Since the introduction ofthe vision-guided Mercedes-Benz robotic van in 1980, when the main emphasis has been on vision-guided systems using LIDAR, radar, GPS, and computer vision, significant advancements in autonomous vehicle technology have been made. This evolved into the autonomous features seen in modern vehicles, such as steer assist, adaptive cruise control, and lane parking.. According to official predictions made by numerous automakers, we will live in a future where fully autonomous automobiles are a reality. One of the leading causes of death worldwide is traffic accidents. By implementing newer, inventive techniques and making investments in road safety at all levels—from the local to the global—this world could stop 5 million human fatalities and 50 million serious injuriesby 2020. The Commission for Global Road Safety thinks it's vital to stop this horrific and needless surge in traffic accidents and start year-over-year reductions (Campbell, 2010). Nearly 3000 individuals each day die in road accidents,according to Deshpande et al., with more than half of those people not travelling in the car. Deshpande et al. also stated that the number of transportation-related injuries is expectedto increase to 2.4 million annually, ranking as the fifth greatestcause of mortality in the world, if urgent and effective action is not done. Because an autonomous system is more reliable and has a quicker reaction time than a human, the number of traffic collisions will consequently significantly decline. Additionally, as autonomous vehicles will result in less need for safety gaps and improved traffic flow management, this would lessen traffic congestion and boost roadway capacity. With the arrival of autonomous vehicles, parking availability will become a historical phenomena because vehicles might pick up passengers, drop them off, park in any available spot, and then pick them up again. There would be less parking available as a result. Physical road signs will become less important as autonomous vehicles obtain all the information they require via a network. There would be less demand for traffic officers. Autonomous vehicles can therefore cut back on government spending on things like traffic enforcement. Along with a decline in automobile theft, there will also be a reduction in the demand for auto insurance. With the complete abolition of redundant passengers, effective vehiclesharing and commodities transport systems (as in the case oftaxis and trucks, respectively) can be established. Autonomous vehicles relieve drivers and navigators of their driving and routing duties because not everyone is capable of doing so. Additionally, commuting times will be shortened because autonomous vehicles can move more quickly with little danger of mistake. The ride will be more comfortable for the car's passengers than it would be in a non-autonomous vehicle. While autonomous vehicles have many advantages,there are also some drawbacks. Although the idea has been disproved, it is still believed that the introduction of autonomous vehicles would result in a decline in occupations involving driving. Another significant difficulty is when drivers lose control of their vehicles because of inexperience, for example. Many individuals enjoy driving, so giving up control of their vehicles would be tough for them. The interaction of autonomous vehicles with human-driven vehicles on the same route also presents difficulties.

Another difficulty with autonomous vehicles is determining who should be held accountable for damage: the government, the car's owners or occupants, or the car manufacturer. Therefore, establishing government laws and putting in placea legal framework for autonomous vehicles is a big challenge. Another significant issue is software reliability. Additionally, there is a chance that the computer or communication system in a car could be hacked. There is a chance that terrorist and criminal activity may increase. For instance, terrorist groups and criminals might pack cars with explosives. They might also be utilised in numerous other crimes and as getaway cars.Autonomous vehicles thus have benefits and drawbacks. Autonomous vehicles thus have benefits and drawbacks. You can find numerous studies that have already been conducted in the development of autonomous vehicles in the review paper that follows.

II. LITERATURE REVIEW

A. *Viorel Stoian. (2017) [1]*

As an autonomous electric vehicle moves close to the obstacle boundaries, he demonstrated fuzzy control algorithms to avoid collisions. A total of four motion cycles are shown (programs used by the autonomous vehicle based on the proximity level, C-1, C-2, C-3, and C4). Every cycle and every proximity level is represented by the directions of the movements. There is an indication of the sequence of the programs based on the proximity level reached. Using a schematic program code, the motion control algorithm demonstrates the evolution of the C- 1 C-2 C-3 C-4 C-1 C-2 functional cycles (programs). 3 tables explain the fuzzy rules for X-axis and Y-axis motions and for thetransition of the programs. Based on the algorithm presented above, the fuzzy controller for electric vehicles is simple. Lastly,simulations are presented. Each program is suitable for a quarter of the object if it is like a circle. Objects that are irregular geometrically have a trajectory following their concave or convex segments. With fuzzy logic controllers, the proximity sensor's reading and movement directions are corrected for small imperfections.

B. *Kyungbok Sung, Kyoungwook Min, and Jeongdan Choi (2018) [2]*

For the purpose of developing autonomous vehicles, they discussed how driving information logs can be used. An analysis of driving information logging can be applied to a number of areas, including the study of autonomous driving systems and accident risk analysis. A study based on the information for autonomous vehicles operating on public roadsin Korea was presented in this paper, although it is expected that it can be applied to other countries and studies as well.

C. *Jian-Gang Wang (2016) [3]*

Using a single image, they presented a two-stage method for recognizing brake lights in real-time. In order to improve accuracy and speed up processing, a convolutional neural network, BVLC Alex Net model, with eight layers is trained on arear-vehicle database obtained by an algorithm for fast vehicledetection. Road segmentation and vanish points are used to improve accuracy. When it comes to detection, lidar and vision are merged. Brakelight recognition is prevented from being affected by taillight pairing problems caused by image noise by a two-stage approach. No matter whether the autonomous vehicle is in the same lane as the target vehicle, the algorithm can detect brake lights.

D. *Funke, Joseph, Paul Theodosis, Rami Hindiyeh, Ganymed Stanek (2015)[4]*

The researchers presented a system that allows an autonomous vehicle to operate at friction limits, which has implications for collision avoidance and accident prevention systems in the future. Unlike other work in this area unique aspect of this workis that , their system tracks a clothoid-based optimized trajectory at the limits of the vehicle's capability in real-time at 200 Hz. During the testing process, the vehicle was successfully driven over paved and unpaved roads, significant banks and grades, and narrow openings on the Pikes Peak Hill Climb course. Modifications to the desired path will be made at runtime in the future. If the vehicle surpasses its limits, it may be necessary to calculate a new path to avoid an obstacle. The controller could be improved by estimating road friction in real-time.

E. *Fagnant, D. J., & Kockelman, K (2015)[5]*

The purpose of this paper is to provide a brief overview of whatopportunities, barriers, and policy recommendations can be made for preparing nations for autonomous vehicles. Additionally, implementation details are included, as well as theimpacts and interactions with other components of the transportation system. These researchers researched in these areas and provided some suggestions on how to determine the appropriate liability, security, and privacy standards for AVs.

F. Gerla, M., Lee, E.-K., Pau, G., & Lee, U. (2014)[6]

According to their findings, car fleets are evolving from sensor platforms to autonomous vehicles interconnected through the Internet. In addition to communications, storage, intelligence, and learning capabilities, the Internet of Vehicles will have capabilities to predict the preferences of the customers. In this article, it is argued that autonomous driving will benefit greatlyfrom the cloud architecture and that the Vehicular Cloud will serve as the equivalent of Internet Cloud for cars. In this presentation, we presented a detailed model of a vehicular cloud, and we discussed potential design perspectives on autonomous vehicles, or AUVs, that need to be explored in the future.

G. Sunwoo, M., K. Jo, Dongchul Kim, J. Kim, and C. Jang. (2014)[7]

Development of a distributed system for an autonomous car was described, along with the system platform used to implement it. Developing an autonomous driving system is best done with a distributed system architecture, because it has many advantages, including reduced computation complexity, fault- tolerant characteristics, and modularity. A distributed system for an autonomous car is designed and integrated according to the development process. Software platform based on layered architecture, developed by AUTOSAR, is applied to distributed systems An AUTOSAR-based layered architecture-based software platform is applied to the distributed system so that itcan be reused, scalable, transferrable, and maintainable. In order to improve system performance, fault tolerance, and network bandwidth, a Flex Ray network is applied to the software platform's main network.

H. Okuda, Ryosuke, Yuki Kajiwara, and Kazuaki Terashima (2014)[8]

The results of the study on the technical trends for autonomousdriving algorithms are presented. Autonomous drivingresearch is still ongoing, advanced algorithms should be developed before a car can be considered autonomous in the real world.

I. Junig wei. (2013)[9]

Using a closed field and public road for over a year, it has taken over a year to develop and test a highly integrated autonomous vehicle. Researchers demonstrate robustness and ease of operation of this platform design in their experiments. Despiteits attractive appearance, the vehicle is equipped with redundant sensors and performs everyday driving. Additionally, fault-tolerance and reliability are built into the system. Developing the vehicle's intelligence is one of the future tasks. As a result, vehicle behavior should be more socially cooperative when it understands an environment's intentions / movements. A better social acceptance will also beachieved by making the on-road planner perform more like skilled drivers who are aware of their social surroundings. This vehicle will be tested in multiple fault tolerance modes to ensure it can still function in the case of a component failure. Furthermore, the vehicle's driving performance will be statistically analyzed through a series of intensive road tests in different driving conditions.

J. Campbell, Mark (2010)[10]

A summary of the current state of autonomy in autonomous vehicles was presented by researchers, along with a description of some of the challenges and opportunities to be encountered as robotic navigation systems evolve. As a resultof participating in the DUC, where numerous technologies had to be integrated into vehicles capable of driving in realistic urban environments, their perspective has been shaped by the experience of developing vehicles capable of driving in urban environments. In the field of robotics, controls, artificial intelligence and many other disciplines related to systems, they see many exciting opportunities for future research.

K. Wenger, Josef. (2005)[11]

They developed concept of automotive radar. The inherent advantages of automotive radar (weather independence, direct measurement of range and velocity, and detection of ground clutter reflections) make it one of the most important technologies that could improve driving safety in the future. The purpose of this contribution is to present the status and future prospects of automotive radar sensors, both long and short range. A new generation of LRRs aims to provide a wider field of view, greater range and angular resolution, and greater system sensitivity. A new quality of environmental sensing will be enabled by this improvement over existing automotive radarsensors. Combined with UWB SRR, future automobiles will become more comfortable and safe. The German Ministry of Education and Research (BMBF) has funded a research project using SiGe technology to develop cost-effective "radar on chip" solutions for future UWB SRRs with small size, low weight, and easy packaging.

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III. CONCLUSION

The basic timeline leading to the creation of autonomous vehicles is covered in this essay. From simple robotic automobiles to more advanced, useful, and practical vision- guided vehicles, autonomous vehicles have evolved. A paradigm shift in the methodology used in autonomous cars was brought about by Ernst Dickmanns and his team's development of the Mercedes-Benz vision-guided autonomous van. Additionally, current advancements in driverless vehicles show what a bright future they have. According to official projections, the majority of automakers will introduce vehicles with semi- and completely autonomous characteristics by 2020. By 2035, the majority of cars are anticipated to be fully driverless, according to the government forecasts previously mentioned. This essay examined the historical background, current advances, and anticipated future of semi- and fully autonomous vehicles for general use.

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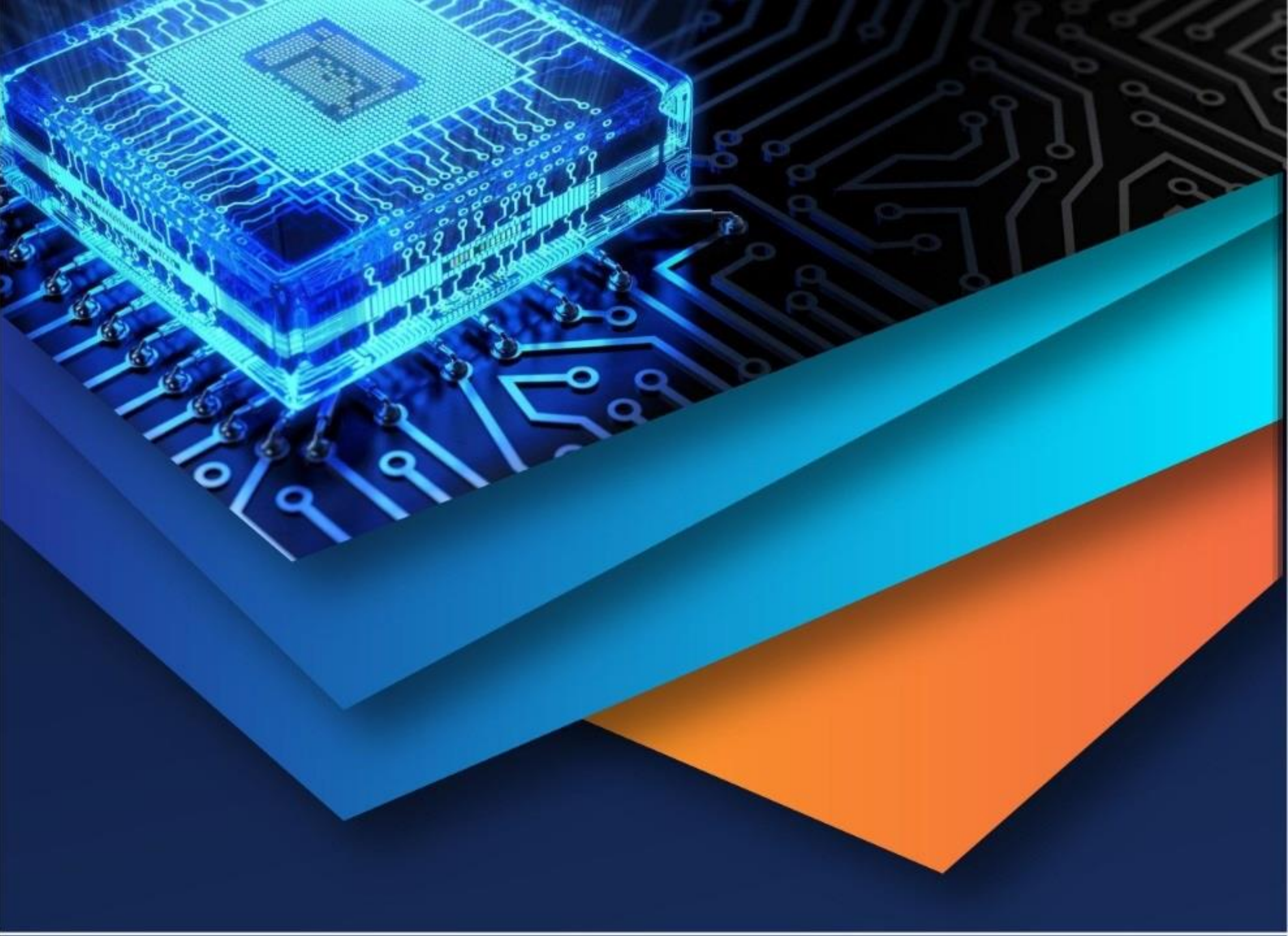

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