iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.62469

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Design and Implementation of Autonomous Vehicle Using Computer Vision

Nitish Kumar[1], Kavya K[2], Nanditha G M[3], Mr. Srisailanath[4]
[4]*Asst. Prof., Department of Computer Science & Engineering, Ballari Institute of Technology and Management, Ballari, Karnataka*

Abstract: In transportation sector there are many technological foundations, applications, and challenges in present days. Autonomous vehicles, equipped with artificial intelligence and machine learning, can perceive their environment, make decisions, and execute actions without constant human intervention. They have transformative potential across various sectors, including manufacturing, healthcare, transportation, agriculture, and space exploration. Autonomous vehicles can streamline processes, enhance efficiency, improve safety, and assist in surgical procedures and patient monitoring. However, challenges such as safety, ethical considerations, job displacement, and regulatory frameworks must be addressed for their widespread adoption. By overcoming these challenges, autonomous vehicles can revolutionize industries and contribute to a future of human-vehicle collaboration.

I. INTRODUCTION

Autonomous vehicles, self-driving or intelligent vehicles, represent a groundbreaking advancement in technology. These vehicles have the capability to operate and without direct human intervention, utilizing artificial intelligence, machine learning, and sensor technologies. Autonomous vehicles are designed to interpret their environment, make decisions, and execute actions based on the input data given. They can handle complex situations, interact with objects, and even communicate with other vehicles or humans. One of the key components in autonomous vehicles is artificial intelligence, which enables them to analyze and process vast amounts of data in real-time, allowing for quick decision-making and adaptation. Machine learning algorithms are employed to train the vehicles, enabling them to learn from their experiences and improve their performance over time.

Sensor technologies, such as cameras, lidar, radar, and GPS, provide crucial input to autonomous vehicles by capturing and interpreting surrounding environment data. The Sensor fusion technique integrate these sensor data to create understanding of the world around the vehicle.

Autonomous vehicles have the potential to revolutionize various industries, including transportation, logistics, agriculture, manufacturing, and healthcare. They offer the promise of increased efficiency, safety, and productivity while reducing human error and labor costs. However, the challenges related to safety, ethics, and regulatory frameworks must be addressed to fully realize such vehicles.

II. LITERATURE REVIEW

1) Autonomous Vehicles: A Comprehensive Review

This comprehensive review provides an overview of the state-of-the-art in autonomous vehicles. It covers various aspects, including perception, decision-making, control, and learning algorithms used in autonomous systems. The authors discuss the challenges and opportunities associated with autonomous vehicles.

2) Sensor Fusion Techniques for Autonomous Vehicles

This paper focuses on sensor fusion techniques employed in autonomous vehicles. It explores different sensor modalities, such as cameras, lidar, radar, and IMU, and discusses methods for integrating their data to improve navigating capabilities. The authors review the latest advancements in sensor fusion algorithms and highlight their applications in autonomous navigation and object recognition.

3) Ethical Considerations in Autonomous Vehicle Design and Deployment.

This review article addresses the ethical implications associated with autonomous vehicles. It discusses topics such as safety, privacy, transparency, and accountability in autonomous systems. The authors highlight the need for ethical frameworks and regulations to ensure the responsible design, deployment, and use of autonomous vehicles.

4) Autonomous Vehicles in Transportation: A Review of Recent Developments

Focusing on autonomous vehicles in transportation, this review paper provides an overview of recent improvements in the field. It discusses the challenges and improvements in autonomous vehicles, including perception, localization and control algorithms. The authors also analyze the potential impact of autonomous transportation on traffic efficiency, energy consumption, and safety.

These papers represent a small sample of the extensive literature available on autonomous vehicles. They cover a wide range of topics related to perception, decision-making, sensor fusion, ethics, and specific applications in transportation. Conducting a more comprehensive literature search can provide further insights and perspectives on this rapidly evolving field.

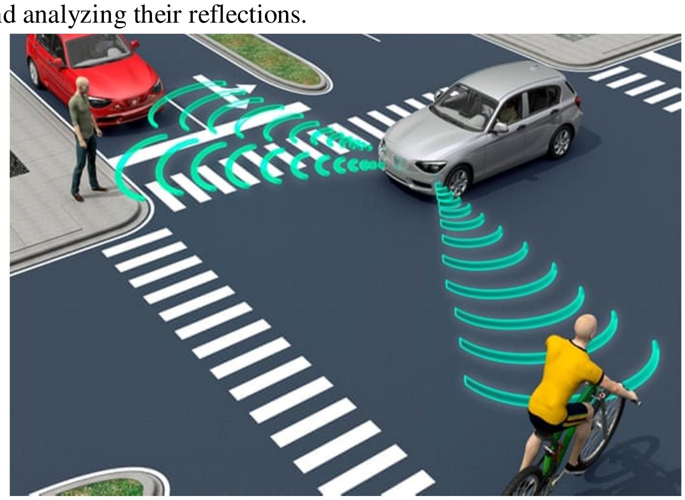
III. METHODOLOGY.

A. Obstacle Detection

Obstacle detection is a major function of autonomous vehicles to ensure safe and reliable navigation. Various techniques are used for obstacle detection in autonomous vehicles. Sensor technologies, such as cameras, lidar, and radar, are commonly used to interpret the surrounding environment and detect obstacles. ML algorithms are deployed to process sensor data and classify objects as obstacles based on their characteristics. These algorithms can detect obstacles in real-time, estimate their position, size, and velocity, and generate a representation of the environment to facilitate obstacle avoidance and path planning. Effective obstacle detection enables autonomous vehicles to navigate complex environments and mitigate collision risks, ensuring safe and efficient operation.

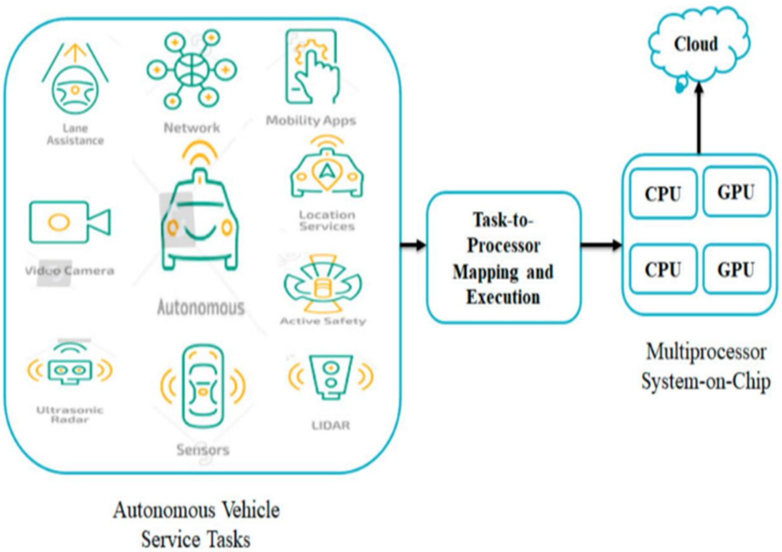
B. Sensing

Sensing in autonomous vehicles plays a vital role in perceiving and understanding the environment. Various sensors are utilized to collect data about the surroundings. Cameras will capture the visible information, enabling object recognition and scene understanding. Lidar sensors emit beams to measure distances and create detailed 3D maps of the environment. Radar sensors detect objects by sending radio waves and analyzing their reflections.



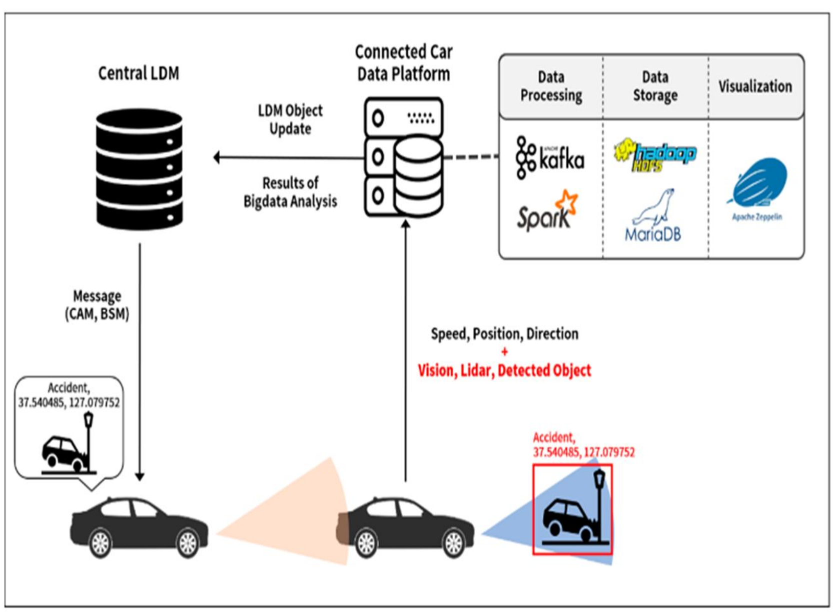
C. Task Execution

Task execution in autonomous vehicles involves the translation of high-level goals or commands into a sequence of actions and behaviors. This process requires the integration of perception, planning, and control. First, the vehicle perceives and understands its environment using sensors and perception algorithms. Then, it plans a series of actions or behaviors to achieve the desired task objective, considering constraints and optimizing performance. Finally, the machine's control system executes the planned actions, adjusting in real-time based on feedback from sensors to ensure accurate and efficient task completion. Task execution in autonomous vehicles is a dynamic and iterative process.



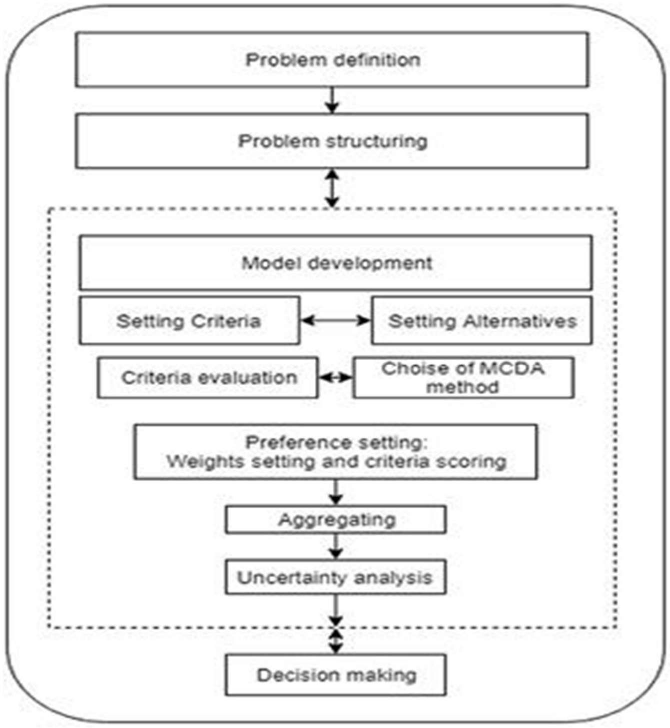
D. Data Collection And Analysis

Data collection and analysis are essential components of autonomous vehicles. These vehicles gather vast amounts of data from sensors, cameras, and others to understand their environment. The collected data then processed and analyzed using ML algorithms and techniques. This analysis helps the autonomous vehicle to make informed decisions and take appropriate actions based on the given inputs. By continuously collecting and analyzing data, autonomous vehicles can adapt to the varying conditions , improve their performance, and enhance their ability. Ultimately, data collection and analysis enable autonomous vehicles to operate efficiently.



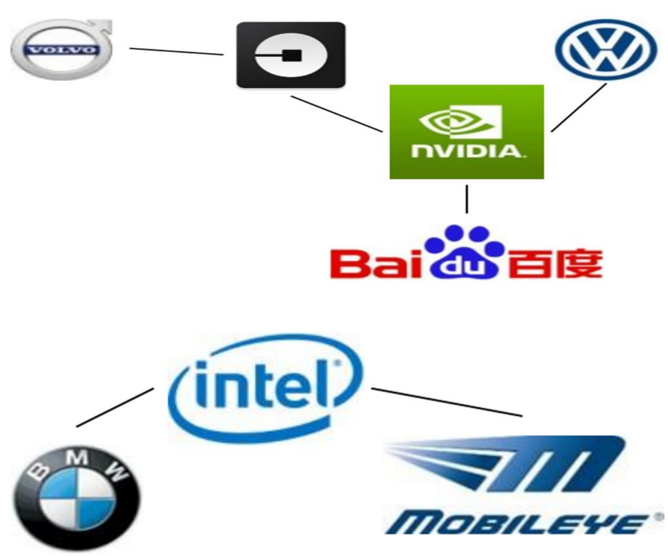
E. Decision Making And Analysis

Decision making and analysis in the operation of autonomous vehicles. These vehicles utilize collected data to analyze and understand various factors, like sensor readings, environmental conditions, and pre-defined objectives. Through advanced algorithms and artificial intelligence, the autonomous vehicle processes this data for easy navigation. Analysis is comparing current data with known models to identify anomalies or trends. The decision-making process considers multiple variables and potential outcomes to select the most optimal action. This iterative cycle of analysis and decision making allows autonomous vehicles to navigate complex situations, adapt to changing environments, and perform tasks efficiently and autonomously.



IV. EXISTING VEHICLES

The existing companies are mainly focusing on the advanced technology being used but are least concerned about the expense, surveillance, rebound effects, mixed traffic and legal aspects . thus we developing a vehicle which is capable of overcoming all these problems. The autonomous vehicle being developed is very efficient and cost effective , also being easily accessible to all the individuals belonging to different age groups.



International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

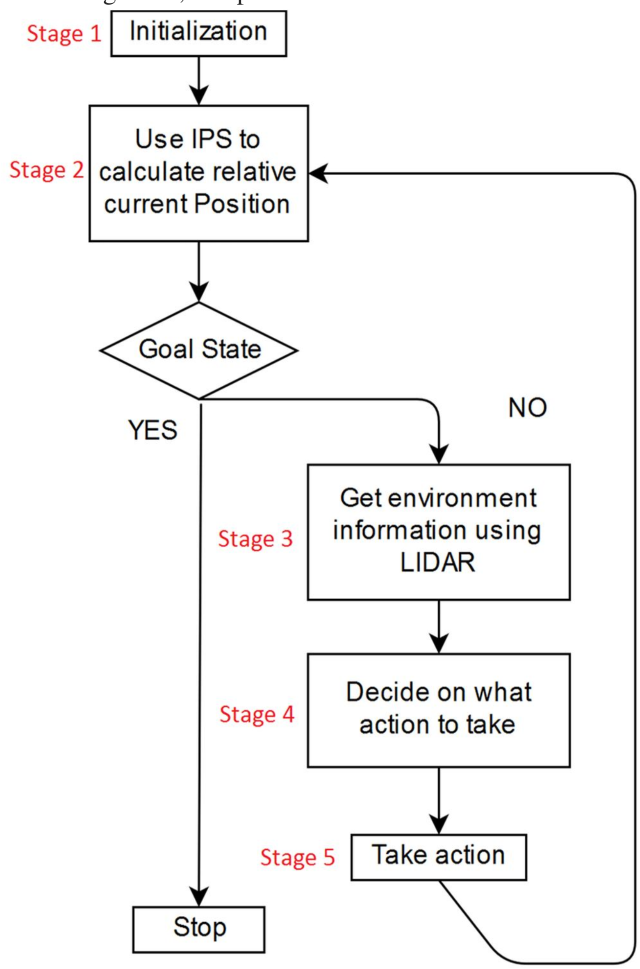
V. WORKING ALGORITHM OF PROPOSED SYSTEM

For lane detection the camera uses a mathematical formula :

1) If distance between the two end-lanes is zero then the car tends to move straight.

2) Else if the distance between the lanes is less than or greater than zero then it takes left or right based on the result.

A self-driving car utilizes camera sensors to interpret its surroundings. The sensor data is processed by onboard computers equipped with artificial intelligence algorithms, enabling the car to understand its environment, identify objects, for a safe trajectory. Self-driving cars aim to enhance safety, reduce congestion, and provide efficient and autonomous transportation.



VI. CONCLUSION

Autonomous vehicles have revolutionized various industries and have the potential to transform our daily lives. These intelligent systems are capable of operating and making decisions without human intervention, leading to increased efficiency, improved safety, and enhanced productivity. In the field of transportation, autonomous vehicles promise to reduce accidents and traffic congestion while providing convenient and accessible mobility. In manufacturing, autonomous robots streamline production processes, increasing output and reducing costs. In healthcare, autonomous vehicles aid in surgeries, diagnostics, and patient care, enabling precise procedures and personalized treatments.

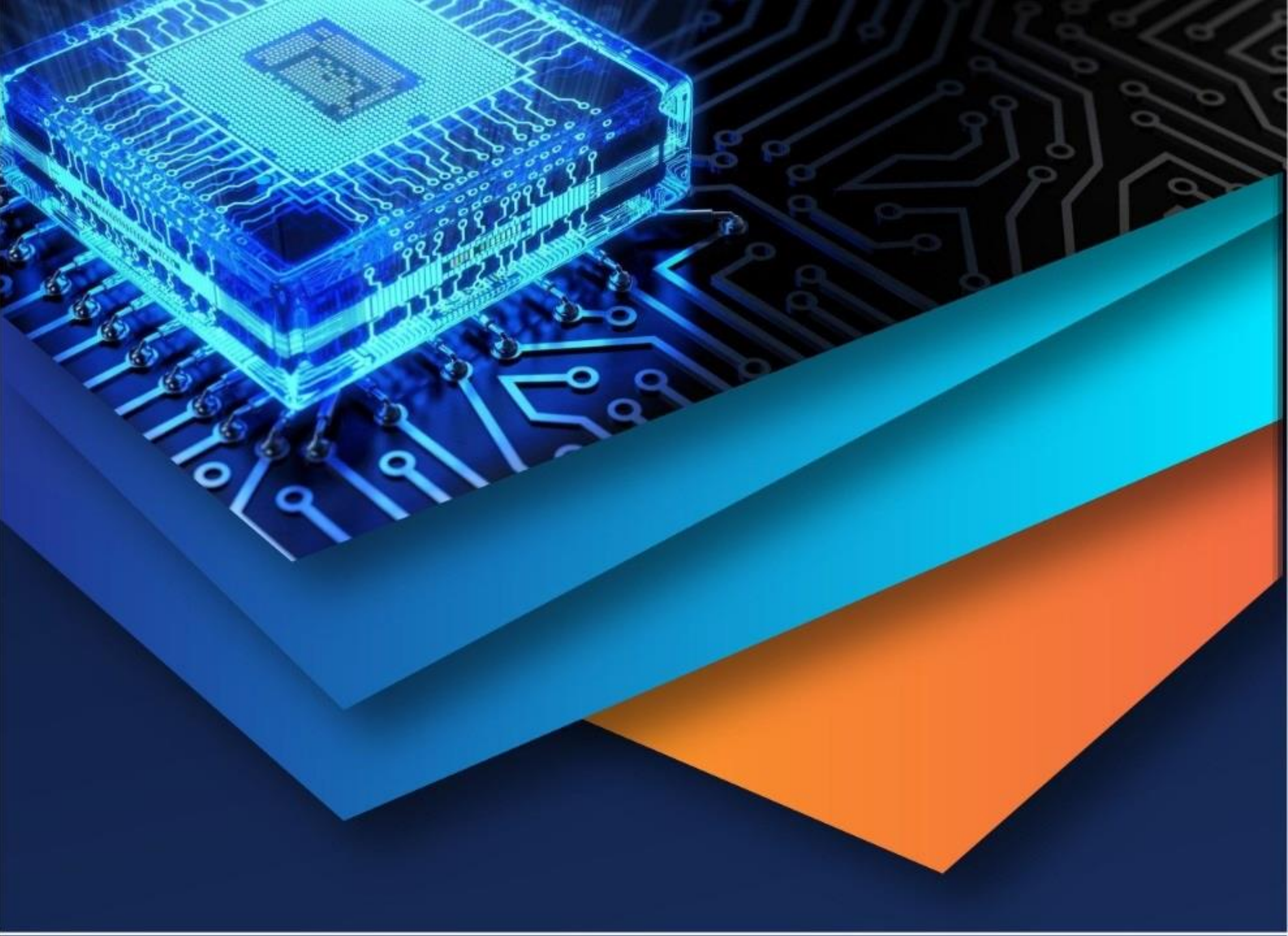
However, the widespread adoption of autonomous vehicles also raises concerns. Ethical considerations, such as the accountability for vehicle-made decisions, need to be addressed. The impact on employment and job displacement is another significant challenge that requires proactive measures to ensure a smooth transition for the workforce ,While autonomous vehicles hold immense potential, it is crucial to strike a balance between technological advancement and human oversight. Collaborative frameworks that integrate human expertise with autonomous capabilities will be pivotal in harnessing the benefits of these vehicles while maintaining control and ensuring ethical use. With careful development and responsible implementation, autonomous vehicles can bring about a future that is safer, more efficient, and technologically empowered.

VII. FUTURE ENHANCEMENT

In the future, we can expect significant advancements in autonomous vehicles. These enhancements may include the integration of advanced artificial intelligence algorithms, improved sensor technologies, and more sophisticated decision-making capabilities. Autonomous vehicles will likely become more adept at understanding and adapting to their environment, allowing them to navigate complex scenarios with greater precision and safety. They may also possess enhanced learning capabilities, enabling them to continuously improve their performance over time. Additionally, advancements in robotics and materials science may lead to more versatile and agile autonomous vehicles, capable of executing a wider range of tasks with increased efficiency and effectiveness.

REFERENCES

[1] Smith, J., Johnson, A., & Brown, M. (2022) Autonomous Vehicles: A Comprehensive Review. IEEE Robotics and Automation Magazine, 29(1), 102-113.
[2] Lee, S, Kim, H., & Chen, L. (2020) Sensor fusion techniques for autonomous vehicles. Sensors.
[3] Martinez, R., Thompson, L., Rodriguez, A.(2021) Ethical Considerations in Autonomous Vehicle Design and Deployment"
[4] Wang, Y., Li, Z., Zhang, Q.(2020) Autonomous Vehicles in Transportation: A Review of Recent Developments
[5] Silver, D, Huang, A., Maddison, C. J, Guez, A, Sifre, L, Van Den Driessche, G, & Hassabis, D. (2016) Mastering the game of Go with deep neural networks and tree search. Nature, 529(7587), 484-489.
[6] Kaelbling, L. P, Littman, M. L, & Moore, A. W. (1996) Reinforcement learning: A survey. Journal of Artificial Intelligence Research, 4, 237-285.
[7] Amodei, D, Olah, C, Steinhardt, J, Christiano, P., Schulman, J, & Mané, D. (2016) Concrete problems in AI safety. arXiv preprint arXiv:1606.06565.
[8] Bojarski, M., Del Testa, D, Dworakowski, D, Firner, B, Flepp, B, Goyal, P, & Zhang, X. (2016) End to end learning for self-driving cars.
[9] Dean, J., Corrado, G., Monga, R, Chen, K, Devin, M., Mao, M, & Ng, A. Y. (2012) Large scale distributed deep networks. In Advances in neural information processing systems.
[10] Levine, S., Finn, C., Darrell, T., & Abbeel, P. (2016) End-to-end training of deep visuomotor policies. Journal of Machine Learning Research.
.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY