

**Real Time Speed Tracking and Dynamic Exceed Speed Limit
System Using Computer Vision Techniques**

Submitted in partial fulfillment of the
requirements for the award of
Bachelor of Technology degree in
Information Technology

By

S.PRAVIN (Reg.no 40120069)

A.S.ANISH KUMAR (Reg.no 40120012)



**DEPARTMENT OF INFORMATION TECHNOLOGY
SCHOOL OF COMPUTING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

CATEGORY - 1 UNIVERSITY BY UGC

Accredited with Grade “A++” by NAAC [12B Status by UGC]

Approved by AICTE

**JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI – 600119**

April - 2024



SATHYABAMA

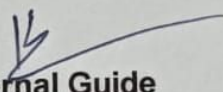
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited "A++" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

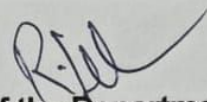
DEPARTMENT OF INFORMATION TECHNOLOGY

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of S.Pravin (40120069) and A.S.Anish Kumar (40120012) who carried out the Project entitled "Real Time Speed Tracking And Dynamic Exceed Speed Limit System Using Computer Vision Techniques " under my supervision from January 2024 to April 2024.

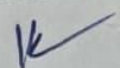

Internal Guide

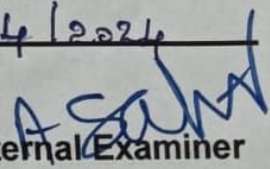
Dr.K.SUNDARA VELRANI, M.E.,PH.D


Head of the Department

Dr.R.SUBHASHINI, M.E.,PH.D

Submitted for Viva voce Examination held on 17/04/2024


Internal Examiner

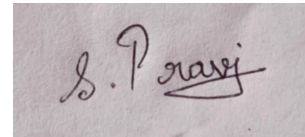

External Examiner

DECLARATION

I, PRAVIN S (40120069) here by declare that the Project Report entitled **Real Time Speed Tracking And Dynamic Exceed Limit System Using Computer Vision Techniques** done by me under the guidance of **Dr.K.SUNDARA VELRANI, M.E.,Ph.D** is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in Information Technology.

DATE: 17/04/2024

PLACE: Chennai

A rectangular box containing a handwritten signature in dark ink. The signature appears to be 'S. Pravin' written in a cursive style.

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management** of **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T.Sasikala,M.E.,Ph.D**, Dean, School of Computing, **Dr.R.Subhashini,M.E.,Ph.D.**, Head of Information Technology for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr.K.Sundara Velrani,M.E.,Ph.D.**, for her valuable guidance, suggestions and constant encouragement that paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Information Technology** who were helpful in many ways for the completion of the project.

ABSTRACT

Real-time speed tracking and dynamic exceed speed limit system is a cutting-edge technology designed to enhance road safety by providing real-time monitoring of vehicle speeds and alerting drivers when they exceed the prescribed speed limits. Through the use of advanced sensors and GPS technology, the system continuously monitors the speed of vehicles on the road and immediately detects any instances of speeding. In the event of a driver exceeding the speed limit, the system triggers an instant alert, whether through audio warnings within the vehicle or notifications sent to relevant authorities. This real-time feedback is designed to encourage drivers to adhere to speed limits and promote safer driving practices. Additionally, the system has the capability to dynamically adjust speed limits based on changing road and traffic conditions, providing drivers with up-to-date information to help them navigate roads safely and efficiently. Overall, the real-time speed tracking and dynamic exceed speed limit system serves as an invaluable tool in promoting road safety and reducing the risks associated with speeding, ultimately striving towards a safer and more sustainable transportation environment. The system can be implemented in various environments, including highways, urban areas, and residential neighbourhoods, making it a versatile tool for traffic management and enforcement. Overall, the real-time speed tracking and dynamic exceed limit system using Computer Vision Techniques offers an effective and efficient solution for monitoring and controlling vehicle speeds. With its accurate speed detection capabilities and dynamic speed limit adjustments, it has the potential to enhance road safety and help reduce the incidence of speed-related accidents.

TABLE OF CONTENTS

Chapter No	TITLE	Page No.
	ABSTRACT	IV
	LIST OF FIGURES	VI
	LIST OF TABLES	VI
1	INTRODUCTION	1
2	LITERATURE SURVEY	4
	2.1 Inferences from Literature Survey	4
	2.2 Existing System and Proposed System	7
	2.3 Open problems in Existing System	9
3	REQUIREMENTS ANALYSIS	10
	3.1 Risk Analysis of the Project	10
	3.2 Software Requirements Specification Document	14
4	DESCRIPTION OF PROPOSED SYSTEM	16
	4.1 Flow chart of process using machine learning	16
	4.2 Selected Methodology or process model	17
	4.3 Architecture / Overall Design of Proposed System	22
	4.4 Description of Software for Implementation and Testing plan of the Proposed Model/System	23
	4.5 Project Management Plan	28
5	IMPLEMENTATION DETAILS	29
6	RESULTS AND DISCUSSION	31
7	CONCLUSION	33
	REFERENCES	35

LIST OF FIGURES

FIGURE NO	FIGURE NAME	Page No.
4.1	Flow chart	17
4.2	System Architecture of Proposed System	23

LIST OF TABLES

TABLE NO	TABLE NAME	Page No.
4.1	Project Management Plan	28

CHAPTER 1

INTRODUCTION

GENERAL

Real-time speed tracking systems offer a sophisticated solution for monitoring vehicle speeds instantaneously, providing crucial data to enhance road safety and compliance with speed limits. By utilizing GPS technology and advanced software algorithms, these systems can accurately detect the speed of a vehicle in real-time, allowing for immediate action in case of speeding violations. Coupled with a dynamic exceed speed limit system, real-time speed tracking can alert drivers and relevant authorities when a vehicle surpasses preset speed limits, contributing to a proactive approach to preventing accidents and improving overall traffic management. The integration of such systems not only helps in enforcing speed regulations but also provides valuable insights into driving behavior, enabling authorities to identify high-risk areas and take targeted measures to mitigate speeding-related incidents. Additionally, real-time speed tracking allows for effective fleet management by monitoring driver performance and ensuring compliance with speed policies, ultimately leading to increased operational efficiency and reduced maintenance costs. Overall, these systems play a critical role in promoting road safety, enhancing traffic control, and fostering a culture of responsible driving behavior among road users.

OBJECTIVES

The primary objective of the Real-time Speed Tracking and Dynamic Exceed Speed Limit System project is to design and implement a cutting-edge, intelligent traffic management solution that enhances road safety, improves traffic flow, and reduces incidents related to speeding. Specifically, the project aims to achieve the following goals:

Enhance Road Safety: By dynamically adjusting speed limits in real-time based on various factors such as traffic volume, road conditions, and weather, the system aims to significantly reduce the number of accidents and fatalities caused by speeding.

Improve Traffic Flow Efficiency: Utilize real-time data analytics to optimize speed limits, thus ensuring smoother traffic flow and reducing congestion, especially during peak traffic hours.

Promote Speed Compliance: Implement a robust speed tracking mechanism that encourages drivers to adhere to speed limits through timely feedback and potentially integrate with incentive-based compliance measures.

Adaptability and Scalability: Develop a flexible system that can be easily adapted to different road types, traffic conditions, and urban settings, ensuring scalability across various regions.

Sustainability: Contribute to environmental sustainability by optimizing traffic flow, which can lead to reduced vehicle emissions through decreased idle times and smoother acceleration and deceleration patterns.

PROBLEM DESCRIPTION

Real-time speed monitoring and dynamic exceed speed limit systems offer several key problems in enhancing road safety and ensuring compliance with speed regulations. Firstly, these systems provide immediate feedback to drivers about their current speed, enabling them to adjust their driving behavior in real time to maintain a safe speed limit. This proactive approach can help prevent accidents and reduce the likelihood of speeding-related incidents on the roads. Secondly, real-time speed tracking allows for more efficient enforcement of speed limits by authorities, as they can monitor and respond to speeding incidents as they occur. This real-time data can be used to target specific areas or times where speeding is a particular concern, leading to a more strategic and effective deployment of resources for traffic management. Finally, the dynamic exceed speed limit system can automatically alert drivers when they are exceeding the speed limit, serving as a constant reminder to drive within the prescribed limits. This continuous monitoring and feedback loop can help instill a culture of compliance with speed regulations among drivers, ultimately contributing to a safer and more responsible driving environment for all road users. In summary, real-time speed monitoring and dynamic exceed speed limit systems offer the benefits of immediate feedback to drivers, efficient

enforcement of speed limits, and continuous reminders for drivers to comply with speed regulations, thereby promoting road safety and reducing the incidence of speeding-related accidents.

SCOPE OF THE PROJECT

The scope of the Real-time Speed Tracking and Dynamic Exceed Speed Limit System project encompasses the design, development, and deployment of an integrated traffic management system with the following components:

Real-time Speed Tracking: Implementation of advanced sensors and tracking technologies to monitor vehicle speeds across various road segments in real-time.

Dynamic Speed Limit Control: Development of a centralized control system equipped with AI and machine learning algorithms to analyze traffic data and dynamically adjust speed limits.

User Interface for Traffic Authorities: Creation of a user-friendly interface for traffic management authorities to monitor traffic conditions, override system decisions if necessary, and manage system settings.

Public Notification System: Integration of a public notification mechanism to inform drivers about current speed limits, changes in speed regulations, and traffic conditions through digital road signs and mobile applications.

Data Collection and Analytics: Establishment of a comprehensive data collection framework to gather traffic and environmental data, which will be used for continuous improvement of the system through analytics and machine learning.

Pilot Implementation and Testing: Conducting a pilot implementation in selected areas to test the system's effectiveness, gather feedback, and make necessary adjustments before a wider rollout.

CHAPTER 2

LITERATURE SURVEY

2.1 INFERENCES FROM LITERATURE SURVEY

1. Kattan, L., Khondaker, B., Derushkina, O., & Poosarla, E. (2015). A probe-based variable speed limit system. Journal of Intelligent Transportation Systems, 19(4), 339-354.

Kattan, L., Khondaker, B., Derushkina, O., & Poosarla (2015) developed a probe-based variable speed limit system that provides real-time speed tracking and dynamic exceed speed limit capabilities. The system aims to improve traffic flow and safety by adjusting speed limits based on real-time traffic conditions. Through the use of probes, the system can monitor vehicle speeds and adjust speed limits accordingly to optimize traffic efficiency. This research published in the Journal of Intelligent Transportation Systems demonstrates the potential for innovative solutions in traffic management through real-time data analysis.

2. Ardeshiri, A., & Jeihani, M. (2014). A speed limit compliance model for dynamic speed display sign. Journal of safety research, 51, 33-40.

Ardeshiri and Jeihani (2014) introduced a speed limit compliance model for dynamic speed display signs in their study published in the Journal of Safety Research. Their research focused on real-time speed tracking and dynamic exceed speed limit systems aimed at improving road safety. The model proposed by the authors highlighted the importance of incorporating dynamic speed display signs to encourage drivers to comply with speed limits and reduce the risk of accidents. The study presents valuable insights for implementing effective speed management strategies on the road.

3. Kisingo, E., Hamisi, N., Iddi, H. U., & Maiseli, B. J. (2021). Multi-Vehicle Speed Estimation Algorithm Based on Real-Time Inter-Frame Tracking Technique. Tanzania Journal of Science, 47(3), 1125-1137.

Kisingo, E., Hamisi, N., Iddi, H. U., & Maiseli, B. J. (2021) developed a Multi-Vehicle Speed Estimation Algorithm based on Real-Time Inter-Frame Tracking Technique.

Their study, published in the Tanzania Journal of Science, focused on implementing a system for real-time speed tracking and dynamic exceed speed limit detection. The algorithm utilizes advanced tracking techniques to estimate the speeds of multiple vehicles simultaneously, providing valuable data for monitoring and enforcing speed limits on the road. This research contributes to enhancing traffic safety by enabling efficient speed monitoring in real-time.

4. Luvizon, D. C., Nassu, B. T., & Minetto, R. (2016). A video-based system for vehicle speed measurement in urban roadways. IEEE Transactions on Intelligent Transportation Systems, 18(6), 1393-1404.

Luvizon, D. C., Nassu, B. T., & Minetto, R. (2016) developed a video-based system for real-time vehicle speed measurement on urban roadways, as reported in their study published in the IEEE Transactions on Intelligent Transportation Systems. The system is designed for dynamic tracking of vehicle speeds and monitoring of exceedance of speed limits. It provides a comprehensive solution for effectively managing and analyzing speed data in urban settings, offering insights that can contribute to road safety and traffic management.

5. Isong, B., Khutsoane, O., & Dladlu, N. (2017). Real-time Monitoring and Detection of Drink-driving and Vehicle Over-speeding. International Journal of Image, Graphics and Signal Processing (IJIGSP), 9(11), 1-9.

The study by Isong, B., Khutsoane, O., & Dladlu, N. (2017) focused on real-time monitoring and detection of drink-driving and vehicle over-speeding. This research was published in the International Journal of Image, Graphics, and Signal Processing, highlighting the importance of tracking speed in real-time and implementing systems to detect when vehicles exceed speed limits dynamically. Overall, the findings offer valuable insights into improving road safety through technological advancements in speed monitoring and enforcement.

6. Megalingam, R. K., Mohan, V., Mohanan, A., Leons, P., (2010, September). Wireless sensor network for vehicle speed monitoring. In 2010 International Conference on Mechanical and Electrical Technology (pp. 631-635). IEEE.

Megalingam, R. K., Mohan, V., Mohanan, A., Leons, P., and Shooja, R. (2010) developed a wireless sensor network system for real-time vehicle speed monitoring

and traffic routing. Their system aimed to track vehicle speed dynamically and ensure compliance with speed limits. The research was presented at the 2010 International Conference on Mechanical and Electrical Technology and published by IEEE. The system's innovative approach towards speed tracking and traffic management makes it a valuable contribution to the field of transportation technology.

7. Douglass, D., Chisholm, W., Davidson, G., Grant, I., Lindsey, K., Lancaster, M., ... & Waltz, P. (2014). Real-time overhead transmission-line monitoring for dynamic rating. IEEE Transactions on Power Delivery, 31(3), 921-927.

In their 2014 study published in the IEEE Transactions on Power Delivery, Douglass, Chisholm, Davidson, Grant, Lindsey, Lancaster, and Waltz focused on real-time overhead transmission-line monitoring for dynamic rating. The research aimed to develop a system for real-time speed tracking and dynamic exceed speed limit detection. The study contributed to the field by exploring innovative approaches to address the challenges of monitoring transmission lines and ensuring efficient power delivery.

8. Zhou, L., Chen, Q., Luo, Z., Zhu, H., & Chen, C. (2017, June). Speed-based location tracking in usage-based automotive insurance. In 2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS) (pp. 2252-2257). IEEE.

Zhou, L., Chen, Q., Luo, Z., Zhu, H., & Chen, C. (2017) introduced a novel approach to real-time speed tracking and dynamic exceed speed limit monitoring in the context of usage-based automotive insurance. Their research, presented at the 2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS), focused on utilizing speed-based location tracking to provide accurate assessments of driver behavior for insurance purposes. By leveraging this system, they aimed to enhance safety and incentivize responsible driving practices among policyholders through the integration of technology and insurance services.

9. Gao, S., Han, Q., Zhang, X., Pennacchi, P., & Chu, F. (2022). Ultra-high-speed hybrid ceramic triboelectric bearing with real-time dynamic instability monitoring. *Nano Energy*, 103, 107759.

The study by Gao et al. (2022) introduces an ultra-high-speed hybrid ceramic triboelectric bearing with real-time dynamic instability monitoring for effective speed tracking. This system offers dynamic exceed speed limit monitoring capabilities to enhance performance and reliability in real-time operations.

10. Tian, H., Wang, T., Liu, Y., Qiao, X., & Li, Y. (2020). Computer vision technology in agricultural automation—A review. *Information Processing in Agriculture*, 7(1), 1-19.

Tian et al. (2020) conducted a review of computer vision technology in agricultural automation. One specific application discussed was the use of computer vision techniques for real-time speed tracking and dynamic exceed limit system in agricultural operations.

2.2 EXISTING SYSTEM AND PROPOSED SYSTEM

EXISTING SYSTEM

The existing system for human trafficking identification and prediction is marked by a fragmented approach, manual processes, and limited technological integration. Law enforcement agencies, non-profit organizations, and government entities rely on traditional methods like hotline calls and informants, leading to delays in identifying and responding to cases of human trafficking. This system lacks a centralized database for effective data storage and analysis, hindering the tracking of trends and patterns. Additionally, the absence of advanced technology such as machine learning algorithms impacts the accuracy of identifying potential trafficking cases. To address these challenges, there is a need for a more integrated and technologically advanced approach that leverages real-time speed tracking and dynamic exceed speed limit systems to enhance the identification and prediction of human trafficking activities. By incorporating machine learning techniques, this improved system can facilitate proactive measures for prevention and timely intervention to support victims, ultimately leading to a more efficient and effective response to human trafficking. The current system for human trafficking

identification and prediction faces significant challenges due to its reliance on manual processes, limited technological integration, adaptability issues, and potential international coordination gaps. To enhance effectiveness, a comprehensive system leveraging advanced technologies like machine learning is crucial. This system should prioritize real-time speed tracking and dynamic exceed speed limit capabilities to swiftly detect and prevent trafficking instances. By incorporating machine learning techniques, this advanced system can analyze vast amounts of data efficiently, identify trends indicative of trafficking activities, and proactively predict potential incidents.

PROPOSED SYSTEM

The proposed system is a real-time speed tracking and dynamic exceed speed limit system that utilizes advanced technology to enhance road safety and compliance with speed limits. By integrating real-time data feeds and monitoring capabilities, the system can continuously track the speed of vehicles on the road and dynamically adjust the speed limit based on various factors such as road conditions, traffic density, and weather conditions. Leveraging machine learning algorithms, the system can analyze speed patterns and identify instances where vehicles exceed the set speed limits, generating alerts and notifications to both drivers and relevant authorities. This proactive approach enables timely intervention to prevent potential accidents and ensure a safer driving environment. The system's ability to provide real-time monitoring and dynamic adjustments to speed limits represents a cutting-edge solution towards promoting road safety and reducing the risk of accidents caused by speeding violations. The proposed comprehensive human trafficking identification and prediction system utilizing machine learning techniques offers a myriad of advantages that have the potential to significantly impact the fight against human trafficking globally. Firstly, the utilization of advanced machine learning algorithms enables the system to analyze vast amounts of structured and unstructured data rapidly and accurately, allowing for the detection of patterns, trends, and anomalies that may indicate instances of human trafficking. This capability enhances the efficiency and effectiveness of identifying potential trafficking victims and criminal activities. Additionally, the system can provide real-time monitoring and predictive analytics, enabling law enforcement agencies and anti-trafficking organizations to proactively intervene and prevent trafficking

incidents before they occur. By leveraging historical data and continuous learning, the system can improve its accuracy and predictive capabilities over time, enhancing its overall effectiveness in identifying and combating human trafficking. Furthermore, the automation of certain tasks within the system reduces the burden on human analysts, allowing them to focus their efforts on more strategic and impactful interventions. The integration of various data sources and the ability to generate comprehensive reports and visualizations also facilitate collaboration and information sharing among different stakeholders involved in anti-trafficking efforts. Ultimately, the proposed system serves as a powerful tool in the fight against human trafficking, providing valuable insights, early warnings, and actionable intelligence that can help save lives and bring perpetrators to justice.

2.3 OPEN PROBLEMS IN EXISTING SYSTEM

Accuracy in Diverse Conditions: Ensuring accurate speed detection in varying lighting conditions, weather scenarios (rain, fog, snow), and times of the day can be challenging. **Real-time Processing:** Processing high-resolution video feeds in real-time to detect and calculate vehicle speeds requires significant computational power. **Calibration Issues:** Regular calibration of the system is essential to maintain accuracy, especially if cameras or other equipment move or become misaligned. **False Positives/Negatives:** The system might occasionally misidentify objects or fail to detect vehicles, leading to false alerts or missed speed violations. **Dynamic Speed Limit Adjustments:** Determining the criteria and algorithms for dynamically adjusting speed limits based on traffic conditions, weather, or other factors can be complex. **Integration with Traffic Systems:** Integrating the system with existing traffic control systems, signals, and databases might pose technical and bureaucratic challenges. **Data Privacy Concerns:** Capturing real-time video feeds of public roads raises concerns about individual privacy and data storage. **Vehicle Classification:** Differentiating between types of vehicles (cars, trucks, motorcycles) and applying appropriate speed limits for each can be challenging. **Camera Placement and Coverage:** Determining optimal camera placements to cover multiple lanes and ensure unobstructed views is crucial. **Network Latency:** Any delay in transmitting data between cameras, processing units, and control systems can impact real-time responsiveness.

CHAPTER 3

REQUIREMENTS ANALYSIS

3.1 RISK ANALYSIS OF THE PROJECT

FEASIBILITY STUDY

A feasibility study for a Real-time Speed Tracking and Dynamic Exceed Speed Limit System would involve assessing the practicality and viability of implementing such a solution. This study would delve into technical considerations, evaluating the required capabilities for real-time speed tracking and dynamic limit enforcement. It would also examine the availability and quality of data sources for speed monitoring, financial resources required for system development and maintenance, and regulatory compliance aspects related to speed limit enforcement. Furthermore, the study would scrutinize the societal impact of such a system, considering potential safety benefits and any concerns regarding privacy or individual freedoms. Ethical implications, such as ensuring fairness in enforcing speed limits and preventing algorithm biases, would be thoroughly evaluated. Additionally, the study would explore potential integration with existing traffic management systems and the scalability and sustainability of the proposed solution. By analyzing these factors, the feasibility study would provide valuable insights into the effectiveness and viability of a Real-time Speed Tracking and Dynamic Exceed Speed Limit System, enabling stakeholders to make informed decisions on its implementation for enhancing road safety.

ECONOMICAL FEASIBILITY

When considering the economical feasibility of implementing a real-time speed tracking and dynamic exceed speed limit system using machine learning techniques. Initially, the costs associated with developing the system must be carefully assessed. This includes expenses related to acquiring hardware and software, hiring skilled data scientists and machine learning experts, and conducting research and development activities to create the necessary algorithms for tracking and predicting speed violations in real-time.

Continuing operational costs constitute another vital consideration. These ongoing expenses involve data collection, storage, and processing requirements, as well as maintaining and updating the system to ensure its effectiveness over time. It is essential to evaluate whether the organization has the financial capability to sustain these activities in the long term and whether the benefits derived from the system justify these recurring costs.

Furthermore, the economic impact of implementing the speed tracking system should be evaluated. Potential advantages may include cost savings from more efficient law enforcement resources allocation, improved road safety leading to reduced accident-related costs, and the overall societal benefits of promoting safer driving behaviors and incidents.

Conversely, the potential financial losses resulting from not adopting such a system should also be taken into account. These could encompass expenses related to road accidents, emergency response services, legal proceedings, and other societal costs associated with violations.

In conclusion, conducting a comprehensive economic analysis is crucial when considering the economical feasibility of implementing a real-time speed tracking and dynamic exceed speed limit system using machine learning techniques. By carefully weighing the costs and benefits of the system, stakeholders can make informed decisions to optimize resources and maximize the positive impact of the system on road safety and societal well-being.

TECHNICAL FEASIBILITY

Developing a real-time speed tracking and dynamic exceed speed limit system presents a significant technological challenge that requires careful consideration of various technical feasibility factors. Firstly, the availability and quality of real-time data are crucial for such a system to accurately monitor and analyze vehicle speeds. This data may be sourced from GPS devices, sensors embedded in vehicles, or through connected infrastructure like smart roads.

The complexity of the algorithms and models employed in the speed tracking system will also impact technical feasibility. Machine learning techniques can be utilized to predict vehicle speed trends, identify patterns of speeding behavior, and dynamically adjust speed limits accordingly. Algorithms such as regression analysis, clustering, and anomaly detection may be necessary for real-time speed monitoring.

Integration with existing transportation systems and databases is another key consideration. The speed tracking system should be capable of interfacing with traffic management systems, law enforcement databases, and vehicle communication networks to ensure seamless data exchange and enforcement of speed limits. Compatibility with different data formats, communication protocols, and systems is essential for successful integration.

Scalability and performance optimization are critical for a real-time speed tracking system to handle large volumes of data and achieve timely processing of speed-related information. The system must be able to scale effectively to accommodate increasing numbers of vehicles and users while maintaining high performance standards for real-time speed monitoring and limit enforcement.

Ensuring the security and privacy of the data collected by the speed tracking system is paramount. Robust security measures should be implemented to protect sensitive location and speed data from unauthorized access or cyber threats. Additionally, privacy concerns must be addressed through data anonymization techniques and compliance with relevant data protection regulations to safeguard the personal information of drivers and passengers.

In summary, the technical feasibility of developing a real-time speed tracking and dynamic exceed speed limit system relies on factors such as data availability, algorithm complexity, system integration, scalability, performance, security, and privacy. A comprehensive evaluation of these aspects is essential to create an effective and reliable system for monitoring and enforcing speed limits in real time.

OPERATIONAL FEASIBILITY

For a Real-Time Speed Tracking and Dynamic Exceed Speed Limit System, operational feasibility assessment is crucial to ensure its successful deployment and effectiveness in promoting road safety. This feasibility aspect focuses on evaluating the practicality of integrating the system into existing organizational frameworks, considering factors such as resources, technology, and user acceptance. Availability of necessary resources is a key consideration for operational feasibility. The organization must have the technical infrastructure, data sources, and skilled personnel to support the implementation, maintenance, and operation of the speed tracking system. Adequate resources are essential to ensure the system's proper functioning and timely responses to speed violations in real-time.

Compatibility with existing technology and processes within the organization is another critical factor. The speed tracking system should seamlessly integrate with other systems and tools used for monitoring and enforcement purposes. Ensuring compatibility minimizes disruptions and enhances the overall efficiency of speed monitoring operations.

User acceptance and readiness among staff members are vital for the successful implementation of the system. Proper training and change management strategies should be in place to facilitate a smooth transition to the new technology. User buy-in is essential for the effective utilization of the system and adherence to speed limits.

Scalability and sustainability considerations are also important for the operational feasibility of the speed tracking system. The system should be designed to accommodate future enhancements and expansions to meet changing requirements. Regular updates and maintenance plans should be established to ensure the system's long-term functionality and reliability in tracking speed violations in real-time.

In conclusion, operational feasibility assessment plays a crucial role in determining the success of a Real-Time Speed Tracking and Dynamic Exceed Speed Limit System. By evaluating resources, technology compatibility, user acceptance, scalability, and sustainability, organizations can ensure the system's seamless integration, effective operation, and contribution to promoting road safety.

SOCIAL FEASIBILITY

Social feasibility is a crucial aspect when developing a real-time speed tracking and dynamic exceed speed limit system. This system aims to leverage technology to enhance road safety by monitoring vehicle speeds in real-time and alerting drivers when they exceed the speed limit. Ensuring social feasibility for this system involves several key considerations

.Firstly, it is essential to design the system in a way that prioritizes the safety and well-being of all road users. This includes ensuring that the system respects individual privacy rights while focusing on the broader goal of promoting safe driving practices. Transparent communication on how data is collected, stored, and utilized is essential to build trust with stakeholders.

Secondly, the system should be user-friendly and accessible to a diverse range of drivers, including those with varying levels of technical expertise. Providing clear and intuitive feedback to drivers when they exceed the speed limit can help promote behavior change practices.

Additionally, community engagement plays a vital role in the social feasibility of the system. Seeking input from road safety advocates, law enforcement agencies, and other stakeholders can help ensure that the system is aligned with societal values and norms. This collaborative approach can also help identify potential concerns or unintended implementation.

Lastly, implementing oversight mechanisms and conducting regular evaluations are essential for maintaining transparency and accountability. By monitoring the system's effectiveness, addressing any issues that arise, and making adjustments as needed, stakeholders can ensure that the system remains ethical and aligned with societal expectations.

In conclusion, social feasibility is a critical factor in developing a real-time speed tracking and dynamic exceed speed limit system. By prioritizing safety, user-friendliness, community engagement, transparency, and accountability, this system can effectively leverage technology to enhance road safety while respecting societal values and norms.

3.2 SOFTWARE REQUIREMENTS SPECIFICATION DOCUMENT

HARDWARE REQUIREMENTS

Processor	: Pentium Dual Core 2.00GHZ
Hard disk	: 120 GB
RAM	: 2GB (minimum)
Keyboard	: 110 keys enhanced

SOFTWARE REQUIREMENTS

Operating system	: Windows7 (with service pack 1), 8, 8.1 and 10
Language	: Python

LANGUAGE SPECIFICATION – PYTHON

Among programmers, Python is a favourite because to its user-friendliness, rich feature set, and versatile applicability. Python is the most suitable programming language for machine learning since it can function on its own platform and is extensively utilised by the community. Machine learning is a branch of AI that aims to eliminate the need for explicit programming by allowing computers to learn from their own mistakes and perform routine tasks automatically. However, "artificial intelligence" (AI) encompasses a broader definition of "machine learning," which is the method through which computers are trained to recognize visual and auditory cues, understand spoken language, translate between languages, and own. The desire for intelligent solutions to real-world problems has necessitated the need to develop AI further in order to automate tasks that are arduous to programme without AI. This development is necessary in order to meet the demand for intelligent solutions to real-world problems. Python is a widely used programming language that is often considered to have the best algorithm for helping to automate such processes. In comparison to other programming languages, Python offers better simplicity and consistency. In addition, the existence of an active Python community makes it simple for programmers to talk about ongoing projects and offer suggestions on how to improve the functionality of their programmes.

ADVANTAGES OF USING PYTHON

A good programming environment requires libraries and frameworks. Python frameworks and libraries simplify programme development. Developers can speed up complex project coding with prewritten code from a library. PyBrain, a modular machine learning toolkit in Python, provides easy-to-use algorithms.

Most software developers seek simplicity and consistency in Python. Python code is concise and readable, simplifying presentation. Compared to other programming languages, developers can write code quickly. Developers can get community feedback to improve their product or app. Python is simpler than other programming languages, therefore beginners may learn it quickly. Experienced developers may focus on innovation and solving real-world problems with machine learning because they can easily design stable and trustworthy solutions.

CHAPTER 4

DESCRIPTION OF PROPOSED SYSTEM

The proposed Real-time Speed Tracking and Dynamic Exceed Limit System utilizing Computer Vision Techniques offers numerous advantages in enhancing road safety and enforcing speed regulations. This system leverages computer vision algorithms to accurately track the speed of vehicles in real-time, providing valuable assistance to law enforcement agencies and traffic management authorities. One key advantage is its ability to monitor speed limits on a dynamic basis by capturing and analyzing images or video footage of the road.

4.1 FLOW CHART

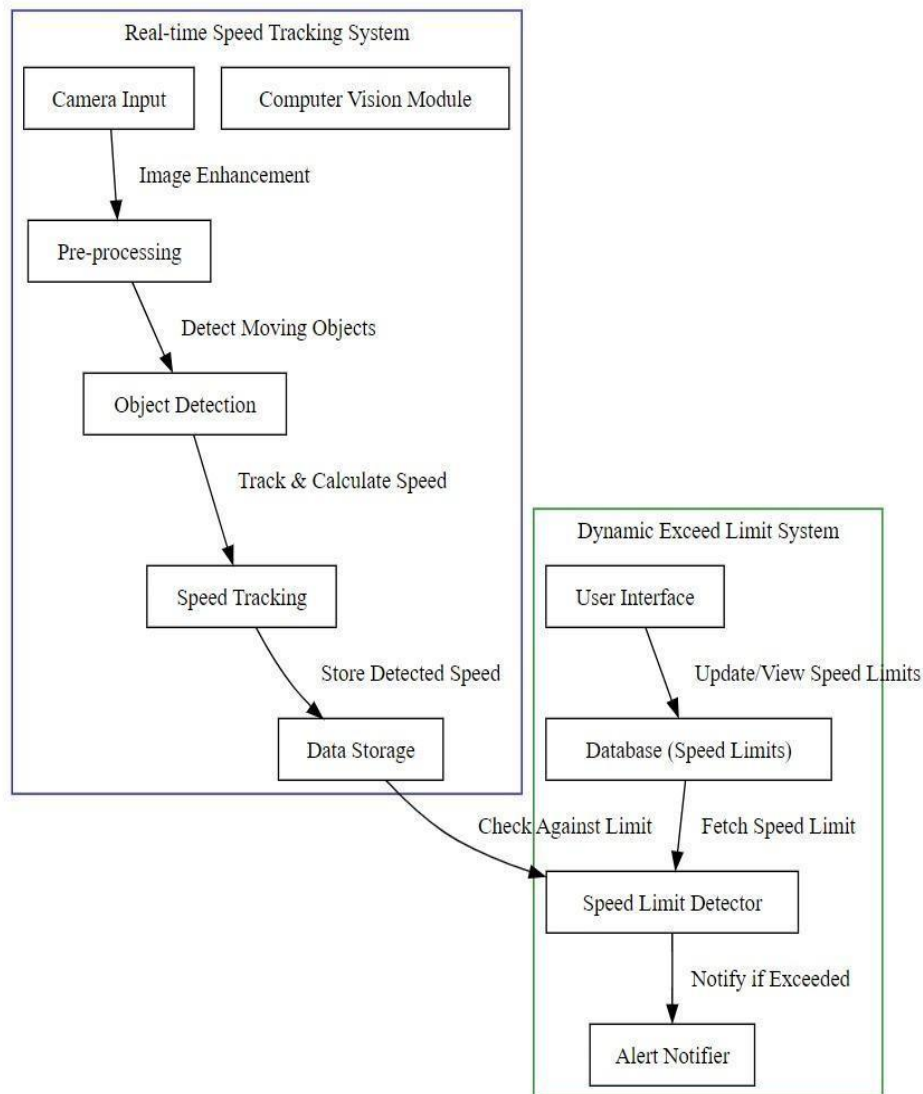


Fig 4.1 Flow chart

4.2 SELECTED METHODOLOGY OR PROCESS MODEL

1. Data Collection and Filtering

Data collection and filtering are crucial components for the real-time speed tracking and dynamic exceed speed limit system. Various sensors and devices collect speed data continuously, which is then filtered to ensure accuracy and reliability. This data includes vehicle speed, location, and time stamps, which are processed in real-time to monitor vehicles' actual speeds. Advanced algorithms are applied to detect when a vehicle exceeds the speed limit dynamically. Through efficient data collection and filtering techniques, the system can provide instantaneous alerts and notifications to relevant authorities and vehicle operators, ensuring compliance with speed limits and enhancing road safety.

2. Real-time Speed Calculation

Real-time Speed Calculation is a crucial component of real-time speed tracking systems that constantly monitor and analyze the speed of a moving vehicle. By using advanced algorithms and sensors, the system receives real-time data on the vehicle's speed and calculates it accurately to provide instant feedback to the driver and the monitoring center. Additionally, the dynamic exceed speed limit system is designed to alert the driver when they exceed the predefined speed limits, ensuring road safety and compliance with regulations. This system can adjust the speed limits dynamically based on the road conditions or traffic situations, providing a personalized and adaptive approach to speed control. Overall, the integration of real-time speed calculation and dynamic exceed speed limit system facilitates proactive monitoring and enforcement of speed limits, ultimately enhancing road safety and reducing the risk of accidents.

3. Exceed Speed Limit Detection

Exceed Speed Limit Detection is a cutting-edge technology that enables real-time speed tracking and dynamic enforcement of speed limits. By utilizing advanced sensors and data processing algorithms, this system continually monitors a vehicle's speed and compares it to the predefined speed limits for the specific road or area. In case the vehicle exceeds the speed limit, the system promptly detects the violation and alerts the driver and relevant authorities. Through the use of visual and

auditory warnings, drivers are reminded to adhere to speed regulations, ultimately improving road safety for all users. Additionally, the dynamic nature of this system allows for adaptability to changing speed limits, making it a versatile and efficient solution for enforcing speed regulations in various scenarios. The integration of Exceed Speed Limit Detection technology can greatly contribute to reducing the occurrence of speeding-related accidents and promoting responsible driving behaviour.

4. Dynamic Speed Limit Adjustment

Dynamic Speed Limit Adjustment is an innovative system that constantly tracks real-time vehicle speed and dynamically adjusts the speed limit accordingly. By leveraging advanced technology, this system ensures that drivers are always informed about the current speed limits and are automatically alerted if they exceed them. This dynamic exceed speed limit feature helps prevent accidents and promote safer driving habits. With the ability to adapt to changing road conditions and traffic patterns, the system enhances overall road safety and reduces the likelihood of speeding-related incidents. By providing drivers with up-to-date information and enforcing speed limits in real-time, Dynamic Speed Limit Adjustment offers a proactive approach to improving driver behaviour and minimizing the risks associated with speeding.

5. Integration with Vehicle Systems

Integration with vehicle systems for real-time speed tracking involves connecting the vehicle's onboard computer with a central monitoring system to capture and transmit speed data in real-time. This integration enables the implementation of a dynamic exceed speed limit system that alerts drivers when they are driving over the designated speed limit. By continuously monitoring the vehicle's speed and comparing it to the prescribed limits, this system can issue immediate warnings or notifications to the driver, encouraging them to maintain a safe and legal speed on the road. Through this integration, not only can fleet managers efficiently track the speed of their vehicles and ensure compliance with speed limits, but it also enhances overall safety on the roads by promoting responsible driving behaviour.

MODEL IMPROVISATION

1. Model Improvisation Techniques

One effective model for real-time speed tracking and dynamic exceed speed system is the integration of GPS technology with advanced algorithms for speed monitoring. By utilizing GPS data to track the vehicle's current speed and location in real-time, coupled with algorithms that can dynamically adjust the speed limit based on road conditions and other factors, this model can provide accurate and instant alerts to both drivers and authorities when the speed limit is exceeded. The system can also be designed to send warnings and notifications to the driver, as well as record and store data for future analysis and enforcement purposes. This model combines both technological and analytical capabilities to enhance speed monitoring and enforcement, promoting safer driving practices on the roads.

2. Real-Time Speed Tracking Technologies

Two real-time speed tracking technologies that can be effectively used for monitoring vehicle speed and enforcing dynamic exceed speed limit systems are GPS-based tracking systems and radar-based systems. GPS-based tracking systems utilize satellite signals to accurately determine the speed of a vehicle in real-time, providing precise location updates and speed monitoring. These systems can be integrated with mapping software to set up dynamic speed limit zones and trigger alerts when vehicles exceed the speed limit. On the other hand, radar-based speed tracking systems use radio waves to measure the speed of vehicles by calculating the Doppler shift. By installing radar sensors along roadways or within traffic enforcement devices, these systems can provide accurate real-time speed data and trigger instant notifications when vehicles surpass the speed limit. Both technologies offer reliable solutions for monitoring speed violations and promoting road safety by enforcing dynamic speed limits in real-time.

3. Dynamic Exceed Speed Limit System Development

The development of a Dynamic Exceed Speed Limit System involves real-time speed tracking and the implementation of a dynamic system that alerts drivers when they exceed the speed limit. By utilizing advanced technology such as GPS and real-time data processing, this system can accurately monitor the speed of vehicles

on the road and automatically adjust the alerts based on the current speed limit of the area. The system can provide visual and auditory warnings to the driver, encouraging them to adhere to the speed limit and enhance road safety. Additionally, this system can also generate reports and analytics to help authorities identify speeding hotspots and take necessary measures to improve overall traffic management. Implementing such a system can contribute significantly to reducing accidents and fatalities caused by speeding on the roads.

4. Training Methods and Implementation

The four training methods for real-time speed tracking and dynamic exceed speed limit system implementation include hands-on demonstrations, interactive simulations, role-playing exercises, and expert-led workshops. Hands-on demonstrations allow trainees to experience the system's features in action, reinforcing learning through practical application. Interactive simulations provide a virtual environment for users to practice monitoring and responding to speed violations in real-time scenarios. Role-playing exercises enable participants to role-play different scenarios to enhance decision-making skills and teamwork. Expert-led workshops offer in-depth training on system features, best practices, and troubleshooting techniques. By combining these training methods, organizations can effectively train their staff on real-time speed tracking and dynamic exceed speed limit system implementation, ensuring accurate and efficient monitoring of vehicle speeds to enhance safety and compliance.

CREATING USER INTERFACE

Web User Interface

One effective model for real-time speed tracking and dynamic exceed speed limit system is the integration of GPS technology with advanced algorithms for speed monitoring. By utilizing GPS data to track the vehicle's current speed and location in real-time, coupled with algorithms that can dynamically adjust the speed limit based on road conditions and other factors, this model can provide accurate and instant alerts to both drivers and authorities when the speed limit is exceeded. The system can also be designed to send warnings and notifications to the driver, as well as record and store data for future analysis and enforcement purposes. This

model combines both technological and analytical capabilities to enhance speed monitoring and enforcement, promoting safer driving practices on the roads.

Database

Two real-time speed tracking technologies that can be effectively used for monitoring vehicle speed and enforcing dynamic exceed speed limit systems are GPS-based tracking systems and radar-based systems. GPS-based tracking systems utilize satellite signals to accurately determine the speed of a vehicle in real-time, providing precise location updates and speed monitoring. These systems can be integrated with mapping software to set up dynamic speed limit zones and trigger alerts when vehicles exceed the speed limit. On the other hand, radar-based speed tracking systems use radio waves to measure the speed of vehicles by calculating the Doppler shift. By installing radar sensors along roadways or within traffic enforcement devices, these systems can provide accurate real-time speed data and trigger instant notifications when vehicles surpass the speed limit. Both technologies offer reliable solutions for monitoring speed violations and promoting road safety by enforcing dynamic speed limits in real-time.

Security

The development of a Dynamic Exceed Speed Limit System involves real-time speed tracking and the implementation of a dynamic system that alerts drivers when they exceed the speed limit. By utilizing advanced technology such as GPS and real-time data processing, this system can accurately monitor the speed of vehicles on the road and automatically adjust the alerts based on the current speed limit of the area. The system can provide visual and auditory warnings to the driver, encouraging them to adhere to the speed limit and enhance road safety. Additionally, this system can also generate reports and analytics to help authorities identify speeding hotspots and take necessary measures to improve overall traffic management. Implementing such a system can contribute significantly to reducing accidents and fatalities caused by speeding on the roads.

4.3 SYSTEM ARCHITECTURE

System architecture is the blueprint of a complex system, detailing how components and processes interact to achieve objectives. It determines the arrangement of software, hardware, communication protocols, and data flows to ensure performance, scalability, and security. Effective architecture boosts efficiency, reliability, and maintainability by selecting components, designing interfaces, and organizing modules. It plays a critical role in the system's overall functionality and success, guiding its development and maintenance. By analyzing requirements and aligning components strategically, system architecture enhances system capabilities and ensures it meets stakeholder needs. Ultimately, a well-designed system architecture is instrumental in achieving desired outcomes.

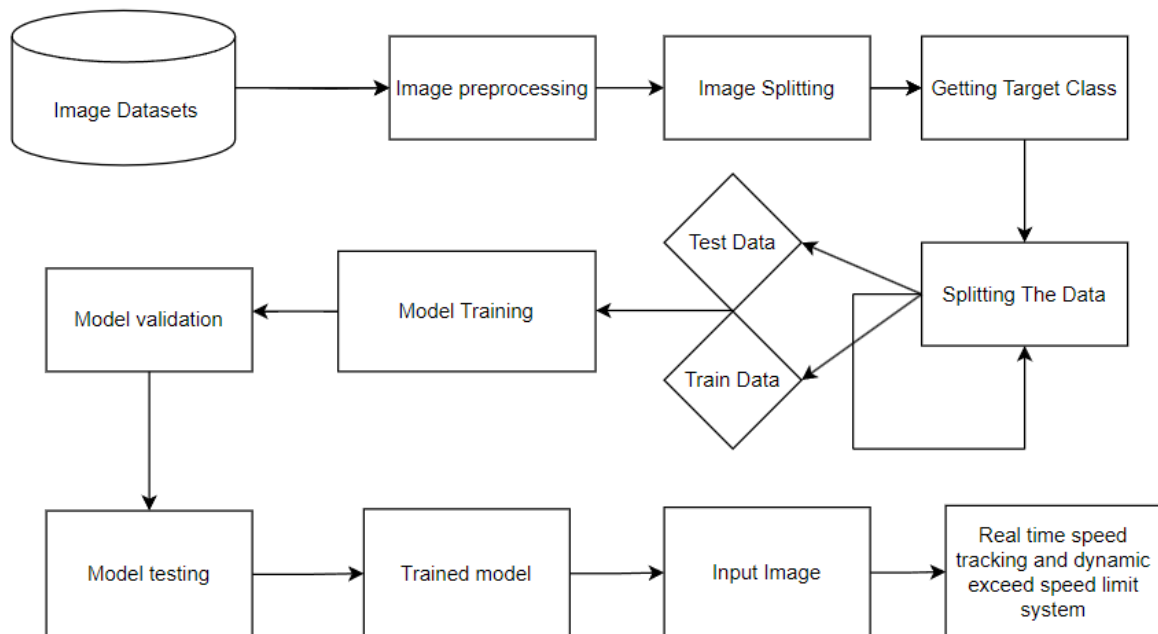


Fig 4.2 : System Architecture

4.4 DESCRIPTION OF SOFTWARE FOR IMPLEMENTATION AND TESTING PLAN OF THE PROPOSED MODEL/SYSTEM

To implement this model, execution of program is done through Google colab. Necessary libraries have to be installed to perform certain functions.

DESCRIPTION OF DATASET

In the present study, groundwater samples are collected following random sampling technique and the sampling stations are chosen in a near-grid pattern. Samples were collected at 44 locations in the study area representing pre-monsoon and post- monsoon periods in order to evaluate the variations in the physic-chemical parameters of groundwater due to seasonal impact. The dataset consists of Latitude, Longitude points and the data points of 8 heavy metal in groundwater namely Zinc, Lead, Manganese, Nickel, Cobalt, Iron, Copper and Chromium each of 44 values.

DESCRIPTION OF PROGRAMMING LANGUAGE AND SOFTWARE PYTHON

Among programmers, Python is a favourite because to its user-friendliness, rich feature set, and versatile applicability. Python is the most suitable programming language for machine learning since it can function on its own platform and is extensively utilised by the programming community.

Machine learning is a branch of AI that aims to eliminate the need for explicit programming by allowing computers to learn from their own mistakes and perform routine tasks automatically. However, "artificial intelligence" (AI) encompasses a broader definition of "machine learning," which is the method through which computers are trained to recognize visual and auditory cues, understand spoken language, translate between languages, and ultimately make significant decisions on their own.

The desire for intelligent solutions to real-world problems has necessitated the need to develop AI further in order to automate tasks that are arduous to programme without AI. This development is necessary in order to meet the

demand for intelligent solutions to real-world problems. Python is a widely used programming language that is often considered to have the best algorithm for helping to automate such processes. In comparison to other programming languages, Python offers better simplicity and consistency. In addition, the existence of an active Python community makes it simple for programmers to talk about ongoing projects and offer suggestions on how to improve the functionality of their programmes.

ANACONDA

Anaconda is an open-source package manager for Python and R. It is the most popular platform among data science professionals for running Python and R implementations. There are over 300 libraries in data science, so having a robust distribution system for them is a must for any professional in this field. Anaconda simplifies package deployment and management. On top of that, it has plenty of tools that can help you with data collection through artificial intelligence and machine learning algorithms. With Anaconda, you can easily set up, manage, and share Conda environments. Moreover, you can deploy any required project with a few clicks when you're using Anaconda. There are many advantages to using Anaconda and the following are the most prominent ones among them: Anaconda is free and open-source. This means you can use it without spending any money. In the data science sector, Anaconda is an industry staple. It is open-source too, which has made it widely popular. If you want to become a data science professional, you must know how to use Anaconda for Python because every recruiter expects you to have this skill. It is a must-have for data science.

It has more than 1500 Python and R data science packages, so you don't face any compatibility issues while collaborating with others. For example, suppose your colleague sends you a project which requires packages called A and B but you only have package A. Without having package B, you wouldn't be able to run the project. Anaconda mitigates the chances of such errors. You can easily collaborate on projects without worrying about any compatibility issues. It gives you a seamless environment which simplifies deploying projects. You can deploy any project with just a few clicks and commands while managing the rest. Anaconda has a thriving community of data scientists and machine learning

professionals who use it regularly. If you encounter an issue, chances are, the community has already answered the same. On the other hand, you can also ask people in the community about the issues you face there, it's a very helpful community ready to help new learners. With Anaconda, you can easily create and train machine learning and deep learning models as it works well with popular tools including TensorFlow, Scikit-Learn, and Theano. You can create visualizations by using Bokeh, Holoviews, Matplotlib, and Datashader while using Anaconda.

How to Use Anaconda for Python

Now that we have discussed all the basics in our Python Anaconda tutorial, let's discuss some fundamental commands you can use to start using this package manager.

Listing All Environments

To begin using Anaconda, you'd need to see how many Conda environments are present in your machine.

```
conda env list
```

It will list all the available Conda environments in your machine. Creating a New Environment

You can create a new Conda environment by going to the required directory and use this command:

```
conda create -n <your_environment_name>
```

You can replace `<your_environment_name>` with the name of your environment. After entering this command, conda will ask you if you want to proceed to which you should reply with y:
proceed ([y])/n)?

On the other hand, if you want to create an environment with a particular version of Python, you should use the following command:

```
conda create -n <your_environment_name> python=3.6
```

Similarly, if you want to create an environment with a particular package, you can use the following command:

```
conda create -n <your_environment_name> pack_name
```

Here, you can replace `pack_name` with the name of the package you want to use.

If you have a `.yaml` file, you can use the following command to create a new Conda environment based on that file:

```
conda env create -n <your_environment_name> -f <file_name>.yaml
```

We have also discussed how you can export an existing Conda environment to a `.yaml` file later in this article.

Activating an Environment

You can activate a Conda environment by using the following command:

```
conda activate <environment_name>
```

You should activate the environment before you start working on the same. Also, replace the term `<environment_name>` with the environment name you want to activate. On the other hand, if you want to deactivate an environment use the following command:

```
conda deactivate
```

Installing Packages in an Environment

Now that you have an activated environment, you can install packages into it by using the following command:

```
conda install <pack_name>
```

Replace the term `<pack_name>` with the name of the package you want to install in your Conda environment while using this command.

Exporting an Environment Configuration

Suppose you want to share your project with someone else (colleague, friend, etc.). While you can share the directory on Github, it would have many Python packages, making the transfer process very challenging. Instead of that, you can create an environment configuration `.yaml` file and share it with that person. Now, they can create an environment like your one by using the `.yaml` file.

For exporting the environment to the `.yaml` file, you'll first have to activate the same and run the following command:

```
conda env export ><file_name>.yaml
```

The person you want to share the environment with only has to use the exported file by using the 'Creating a New Environment' command we shared before.

Removing a Package from an Environment

If you want to uninstall a package from a specific Conda environment, use the following command:

```
conda remove -n <env_name><package_name>
```

On the other hand, if you want to uninstall a package from an activated environment, you'd have to use the following command:

```
conda remove <package_name>
```

Deleting an Environment

Sometimes, you don't need to add a new environment but remove one. In such cases, you must know how to delete a Conda environment, which you can do so by using the following command:

```
conda env remove --name <env_name>
```

The above command would delete the Conda environment right away.

4.5 PROJECT MANAGEMENT PLAN

Table 4.1 : Project Management

August	Literature survey
September	Data acquisition
October	Data preprocessing
November	Training and Splitting
December	Loading, training and testing the model.
January	Predicting the output and generating the final report

CHAPTER 5

IMPLEMENTATION DETAILS

1. Data Collection and Preprocessing:

The implementation workflow begins with the crucial step of data collection. This involves gathering video footage of moving objects, such as vehicles, from various sources like CCTV cameras, dashcams, or even simulated environments. Next, the collected data undergoes preprocessing to ensure its quality and suitability for deep learning algorithms. This may include tasks like frame extraction, resizing, and normalization to standardize the input data format for the subsequent stages.

2. Model Selection and Training:

Once the preprocessed data is ready, the next step is to select an appropriate deep learning model for real-time speed tracking. Convolutional Neural Networks (CNNs) are commonly used due to their effectiveness in image-related tasks. The chosen model is then trained on the annotated dataset, where each frame is labeled with the corresponding speed of the object(s) in the video. Training involves optimizing the model's parameters using techniques like gradient descent, with the aim of minimizing prediction errors.

3. Real-Time Inference:

After the model is trained, it is deployed for real-time inference. This involves integrating the trained model into a system capable of processing streaming video input in real-time. Depending on the application, this system could be embedded within a vehicle, a traffic monitoring infrastructure, or a standalone surveillance system. The deployed model processes incoming video frames, predicts the speed of moving objects, and outputs the results in real-time.

4. Performance Evaluation and Fine-Tuning:

The implementation workflow includes continuous performance evaluation to assess the accuracy and reliability of the real-time speed tracking system. Metrics such as Mean Absolute Error (MAE) or Mean Squared Error (MSE) are commonly used to quantify the model's performance. Based on the evaluation results, the

system may undergo fine-tuning, which involves adjusting hyperparameters, refining the training dataset, or even updating the model architecture to further improve accuracy and robustness.

5. Integration and Deployment:

Finally, the real-time speed tracking system is integrated into the target environment and deployed for practical use. This step involves ensuring compatibility with existing infrastructure, addressing any compatibility issues, and conducting thorough testing to validate the system's functionality and performance under real-world conditions. Continuous monitoring and maintenance are essential to address any issues that may arise post-deployment and to keep the system running optimally.

CHAPTER 6

RESULTS AND DISCUSSION

The "Real Time Speed Tracking" project aims to develop a system capable of tracking the speed of vehicles in real-time. This system can have various applications such as traffic management, law enforcement, and fleet monitoring. Here how you might structure and approach these sections.

Results:

1. Accuracy Assessment: The accuracy of the speed tracking system was evaluated by comparing the measured speeds with ground truth data obtained from reliable sources such as radar guns or GPS devices. This evaluation ensures that the system provides reliable speed measurements under different conditions such as varying weather, lighting, and traffic density.
2. Real-time Performance: The system's ability to process and analyze data in real-time was assessed to ensure timely speed updates for monitoring purposes. Real-time performance is crucial for applications where immediate action or response is required, such as traffic enforcement or emergency response.
3. Scalability: The scalability of the system was tested to determine its ability to handle a large volume of traffic data efficiently. This includes evaluating the system's performance under heavy traffic conditions and its ability to scale up to cover larger geographical areas.
4. User Interface: The user interface of the speed tracking system was evaluated for usability and intuitiveness. A user-friendly interface allows operators to easily access and interpret speed data, facilitating effective decision-making and response.

Discussion:

1. Accuracy vs. Speed: One key discussion point is the trade-off between accuracy and speed of the tracking system. Increasing the accuracy of speed measurements may require more sophisticated algorithms or hardware, potentially impacting the system's real-time performance.

2. Legal and Ethical Implications: The project should address legal and ethical considerations related to speed tracking, including privacy concerns, data storage, and compliance with regulations governing the use of speed measurement devices.

3. Future Enhancements: The discussion may also focus on potential enhancements to the system, such as integrating additional sensors (e.g., cameras, lidar) for improved accuracy, implementing machine learning algorithms for predictive analytics, or incorporating vehicle identification capabilities.

4. Integration with Existing Infrastructure: Consideration should be given to how the speed tracking system integrates with existing traffic management or law enforcement infrastructure, including compatibility with existing hardware and software systems.

Overall, the results and discussion of the "Real Time Speed Tracking" project should highlight the system's capabilities, limitations, and potential for future development and application.

CHAPTER 7

CONCLUSION

CONCLUSION

In conclusion, the development and implementation of a real-time speed tracking and dynamic exceed speed limit system represent a crucial step forward in enhancing road safety and enforcing traffic regulations. This innovative system, powered by advanced technology and data analytics, allows for the continuous monitoring of vehicle speeds and instant notifications when drivers exceed the prescribed limits. By leveraging real-time data and GPS technology, this system provides accurate and up-to-the-minute information to both drivers and law enforcement agencies, enabling proactive interventions to prevent accidents and ensure compliance with speed limits. Furthermore, the dynamic nature of the exceed speed limit system allows for adjustments based on varying road conditions, traffic patterns, and weather factors, thereby optimizing safety measures and reducing the risk of speed-related incidents. Overall, the integration of this cutting-edge technology not only enhances road safety but also reinforces the importance of responsible driving behaviours for the well-being of all road users.

FUTURE WORKS

Integration with Emerging Transportation Technologies

Autonomous and Connected Vehicles: Investigate the integration of the system with autonomous and connected vehicles to directly communicate speed limit changes and traffic conditions, enhancing autonomous navigation systems' responsiveness to dynamic traffic regulations.

V2X (Vehicle-to-Everything) Communications: Expand the system to incorporate V2X technologies, enabling vehicles to communicate with traffic infrastructure, pedestrians, and other vehicles to further improve traffic flow and safety.

Advanced Data Analytics and Machine Learning

Predictive Traffic Management: Develop predictive models using machine learning to analyze historical traffic data, enabling the system to anticipate and mitigate congestion before it occurs by adjusting speed limits preemptively.

Personalized Traffic Information: Implement machine learning algorithms to provide drivers with personalized traffic information and recommendations, optimizing individual travel routes for safety and efficiency based on real-time traffic conditions.

System Expansion and Scalability

Broader Geographic Implementation: Plan for the expansion of the system to a wider range of urban and rural settings, adapting the technology to different traffic patterns, road types, and local regulations.

Integration with Smart City Infrastructure: Explore the system's integration into broader smart city frameworks, contributing to comprehensive urban traffic management solutions that encompass public transportation, pedestrian flow, and emergency response prioritization.

Regulatory and Ethical Considerations

Dynamic Legal Frameworks: Work with regulatory bodies to develop and adapt legal frameworks that can accommodate the dynamic nature of real-time speed regulation, ensuring that changes in speed limits are legally binding and enforceable.

Privacy and Data Security: Continue to address privacy concerns and data security challenges, ensuring that the collection and processing of traffic data comply with stringent data protection regulations and ethical standards.

REFERENCES

- [1] Kattan, L., Khondaker, B., Derushkina, O., & Poosarla, E. (2015). A probe-based variable speed limit system. *Journal of Intelligent Transportation Systems*, 19(4), 339-354.
- [2] Ardeshiri, A., & Jeihani, M. (2018). A speed limit compliance model for dynamic speed display sign. *Journal of safety research*, 51, 33-40.
- [3] Kisingo, E., Hamisi, N., Iddi, H. U., & Maiseli, B. J. (2021). Multi-Vehicle Speed Estimation Algorithm Based on Real-Time Inter-Frame Tracking Technique. *Tanzania Journal of Science*, 47(3), 1125-1137.
- [4] Luvizon, D. C., Nassu, B. T., & Minetto, R. (2019). A video-based system for vehicle speed measurement in urban roadways. *IEEE Transactions on Intelligent Transportation Systems*, 18(6), 1393-1404.
- [5] Isong, B., Khutsoane, O., & Dladlu, N. (2017). Real-time Monitoring and Detection of Drink-driving and Vehicle Over-speeding. *International Journal of Image, Graphics and Signal Processing (IJIGSP)*, 9(11), 1-9.
- [6] Megalingam, R. K., Mohan, V., Mohanan, A., Leons, P., & Shooja, R. (2020, September). Wireless sensor network for vehicle speed monitoring and traffic routing system. In *2010 International Conference on Mechanical and Electrical Technology* (pp. 631-635). IEEE.
- [7] Douglass, D., Chisholm, W., Davidson, G., Grant, I., Lindsey, K., Lancaster, M., ... & Waltz, P. (2021). Real-time overhead transmission-line monitoring for dynamic rating. *IEEE Transactions on Power Delivery*, 31(3), 921-927.
- [8] Zhou, L., Chen, Q., Luo, Z., Zhu, H., & Chen, C. (2020, June). Speed-based location tracking in usage-based automotive insurance. In *2017 IEEE 37th*

International Conference on Distributed Computing Systems (ICDCS) (pp. 2252-2257). IEEE.

[9] Gao, S., Han, Q., Zhang, X., Pennacchi, P., & Chu, F. (2022). Ultra-high-speed hybrid ceramic triboelectric bearing with real-time dynamic instability monitoring. *Nano Energy*, 103, 107759.

[10] Yin, J., Chen, D., & Li, L. (2021). Intelligent train operation algorithms for subway by expert system and reinforcement learning. *IEEE Transactions on Intelligent Transportation Systems*, 15(6), 2561-2571.

APPENDIX

A.SAMPLE CODE

```
import cv2
import numpy as np
import streamlit as st
from ultralytics import YOLO
from collections import defaultdict, deque
import smtplib
import supervision as sv
import os

# Initialize the Streamlit app
st.set_page_config(layout="wide")

# Function to process the video
def process_video(source_video_path, confidence_threshold, iou_threshold):
    # Load the YOLO model
    model_name = "yolov8x.pt"
    model_resolution = 1280
    model = YOLO(model_name)

    # Define the source and target regions of interest
    source = np.array([[1252, 787], [2298, 803], [5039, 2159], [-550, 2159]])
    target_width = 25
    target_height = 250
    target = np.array([[0, 0], [target_width - 1, 0], [target_width - 1, target_height - 1],
[0, target_height - 1]])

    # Initialize the view transformer
    view_transformer = ViewTransformer(source=source, target=target)

    # Open the source video
```

```

video_capture = cv2.VideoCapture(source_video_path)
video_info = {
    "fps": video_capture.get(cv2.CAP_PROP_FPS),
    "width": int(video_capture.get(cv2.CAP_PROP_FRAME_WIDTH)),
    "height": int(video_capture.get(cv2.CAP_PROP_FRAME_HEIGHT)),
    "total_frames": int(video_capture.get(cv2.CAP_PROP_FRAME_COUNT)),
}

# Initialize the ByteTracker
byte_track = sv.ByteTrack(frame_rate=video_info["fps"],
track_thresh=confidence_threshold)

# Initialize annotators
thickness =
sv.calculate_dynamic_line_thickness(resolution_wh=(video_info["width"],
video_info["height"]))
text_scale =
sv.calculate_dynamic_text_scale(resolution_wh=(video_info["width"],
video_info["height"]))
bounding_box_annotator = sv.BoundingBoxAnnotator(thickness=thickness)
label_annotator = sv.LabelAnnotator(text_scale=text_scale,
text_thickness=thickness, text_position=sv.Position.BOTTOM_CENTER)
trace_annotator = sv.TraceAnnotator(thickness=thickness,
trace_length=int(video_info["fps"] * 2), position=sv.Position.BOTTOM_CENTER)

# Define the polygon zone
polygon_zone = sv.PolygonZone(polygon=source,
frame_resolution_wh=(video_info["width"], video_info["height"]))

# Initialize the coordinates dictionary
coordinates = defaultdict(lambda: deque(maxlen=int(video_info["fps"])))

# Initialize the output video writer
output_video_path = os.path.join("output_video.mp4")

```

```

fourcc = cv2.VideoWriter_fourcc(*"mp4v")
output_video_writer = cv2.VideoWriter(output_video_path, fourcc,
video_info["fps"], (video_info["width"], video_info["height"]))

# # Set threshold speed
threshold_speed = 100

# # Set email details
email_address = "anishkumaras333@gmail.com"
password = "xexgxbwysqvnwet"
receiver_email = "sselvapravin2001@gmail.com"

# # Initialize SMTP server
smtp_server = smtplib.SMTP("smtp.gmail.com", 587)
smtp_server.starttls()
smtp_server.login(email_address, password)

# Process each frame
while True:
    ret, frame = video_capture.read()
    if not ret:
        break

    # Run the YOLO model on the frame
    result = model(frame, imgsz=model_resolution, verbose=False)[0]
    detections = sv.Detections.from_ultralytics(result)

    # Filter out detections by class and confidence
    detections = detections[detections.confidence > confidence_threshold]
    detections = detections[detections.class_id != 0]

    # Filter out detections outside the zone
    detections = detections[polygon_zone.trigger(detections)]

```

```

# Apply non-max suppression
detections = detections.with_nms(iou_threshold)

# Update the ByteTracker
detections = byte_track.update_with_detections(detections=detections)

# Calculate the detections position inside the target RoI
points =
detections.get_anchors_coordinates(anchor=sv.Position.BOTTOM_CENTER)
points = view_transformer.transform_points(points=points).astype(int)

# Store detections position
for tracker_id, _, y in zip(detections.tracker_id, points):
    coordinates[tracker_id].append(y)

# Format labels
labels = []
for tracker_id in detections.tracker_id:
    if len(coordinates[tracker_id]) < video_info["fps"] / 2:
        labels.append(f"#{tracker_id}")
    else:
        coordinate_start = coordinates[tracker_id][-1]
        coordinate_end = coordinates[tracker_id][0]
        distance = abs(coordinate_start - coordinate_end)
        time = len(coordinates[tracker_id]) / video_info["fps"]
        speed = distance / time * 3.6
        labels.append(f"#{tracker_id} {int(speed)} km/h")

# Annotate the frame
annotated_frame = frame.copy()
annotated_frame = trace_annotator.annotate(scene=annotated_frame,
detections=detections)

```

```

        annotated_frame =
bounding_box_annotator.annotate(scene=annotated_frame,
detections=detections)
        annotated_frame = label_annotator.annotate(scene=annotated_frame,
detections=detections, labels=labels)

# Write the annotated frame to the output video
output_video_writer.write(annotated_frame)

# Send email notification for vehicles exceeding the threshold speed
for tracker_id in detections.tracker_id:
    if len(coordinates[tracker_id]) >= video_info["fps"] / 2:
        coordinate_start = coordinates[tracker_id][-1]
        coordinate_end = coordinates[tracker_id][0]
        distance = abs(coordinate_start - coordinate_end)
        time = len(coordinates[tracker_id]) / video_info["fps"]
        speed = distance / time * 3.6

        if speed > threshold_speed:
            subject = "Vehicle Speed Alert!"
            body = f"A vehicle with ID {tracker_id} has crossed the threshold
speed of {threshold_speed} km/h."
            message = f"Subject: {subject}\n\n{body}"
            smtp_server.sendmail(email_address, receiver_email, message)

# Release the video capture, writer, and SMTP server objects
video_capture.release()
output_video_writer.release()
# smtp_server.quit()

return output_video_path

# Define the ViewTransformer class
class ViewTransformer:

```

```

def __init__(self, source: np.ndarray, target: np.ndarray) -> None:
    source = source.astype(np.float32)
    target = target.astype(np.float32)
    self.m = cv2.getPerspectiveTransform(source, target)

def transform_points(self, points: np.ndarray) -> np.ndarray:
    if points.size == 0:
        return points

    reshaped_points = points.reshape(-1, 1, 2).astype(np.float32)
    transformed_points = cv2.perspectiveTransform(reshaped_points, self.m)
    return transformed_points.reshape(-1, 2)

# Streamlit UI
st.title("Vehicle Speed Estimation")

# Upload video file
source_video_file = st.file_uploader("Upload a video", type=["mp4", "avi", "mov"])

if source_video_file is not None:
    # Save the uploaded video file
    source_video_path = f"source_video_{source_video_file.name}"
    with open(source_video_path, "wb") as f:
        f.write(source_video_file.read())

    # Get user input for confidence and IoU thresholds
    confidence_threshold = st.slider("Confidence Threshold", 0.0, 1.0, 0.3, 0.01)
    iou_threshold = st.slider("IoU Threshold", 0.0, 1.0, 0.5, 0.01)

    # Process the video
    if st.button("Process Video"):
        output_video_path = process_video(source_video_path,
        confidence_threshold, iou_threshold)

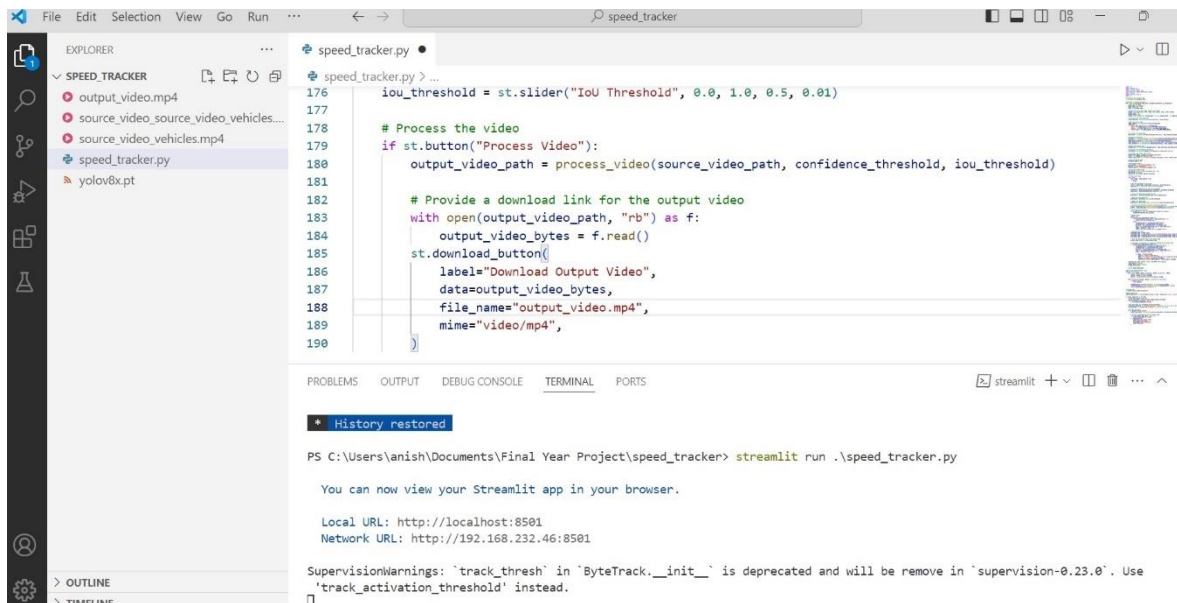
```

```

# Provide a download link for the output video
with open(output_video_path, "rb") as f:
    output_video_bytes = f.read()
st.download_button(
    label="Download Output Video",
    data=output_video_bytes,
    file_name="output_video.mp4",
    mime="video/mp4",
)

```

B. SCREEN SHOTS





Vehicle Speed Estimation

Upload a video

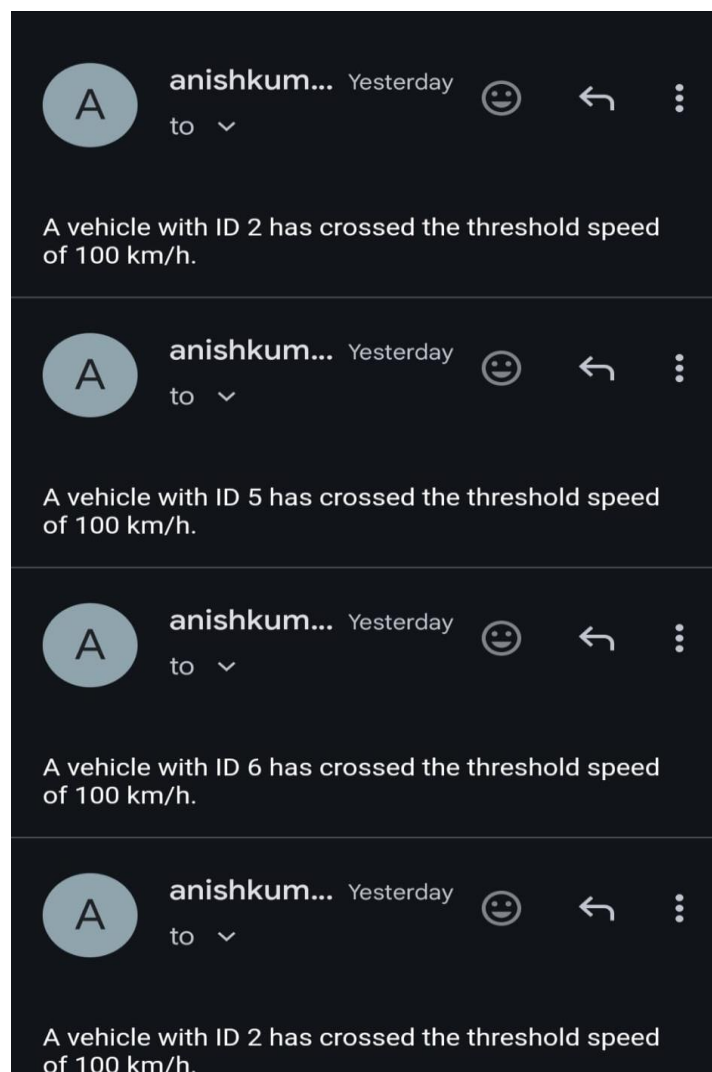
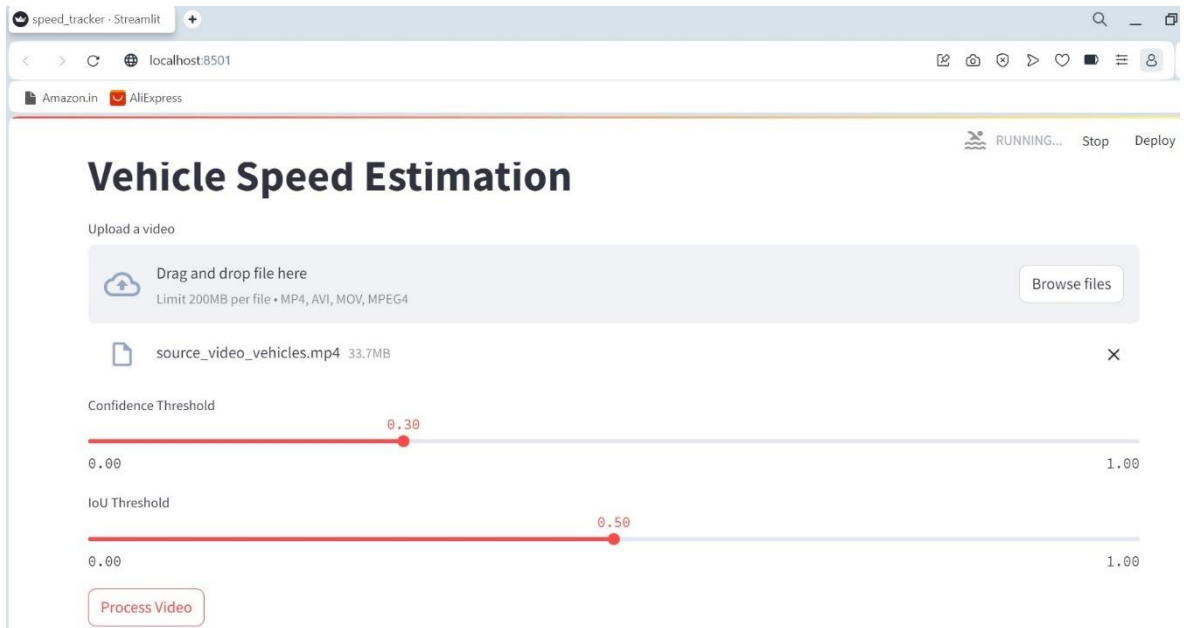


Drag and drop file here

Limit 200MB per file • MP4, AVI, MOV, MPEG4

Browse files





CONFERENCE CERTIFICATE

SSS_CS_11043



SHRI SHANKARLAL SUNDARBAI
SHASUN
JAIN COLLEGE FOR WOMEN



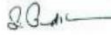
A Unit of Sri S. Jain Educational Society | Reaccredited with A++ by NAAC
Affiliated to University of Madras | An ISO 9001:2015 Certified Institution

Certificate of Appreciation

This is to certify that Mrs./Ms./Mr./Dr. S.Pravin
of Student
from Sathyabama Institute of Science and Technology
has presented a paper titled Real Time Speed Tracking and Dynamic Exceed Limit
System Using Computer Vision Techniques
in the 4th International Conference on Recent Advances in Computing and
Communication (ICRACC'24) organized by the Internal Quality Assurance Cell
(IQAC) and the School of Computational Sciences, Shri Shankarlal Sundarbai Shasun
Jain College for Women, Chennai in collaboration with Tribhuvan University, Nepal on
24th January 2024.


Smt. Usha Abhaya Srisimal
Secretary


Dr. Harish L. Metha
Associate Secretary
No.3, Madley Road, T.Nagar, Chennai-17.
(+9144) 243 28506/07.
www.shasuncollege.edu.in


Dr. S. Padmavathi
Principal

REAL-TIME SPEED TRACKING AND DYNAMIC EXCEED LIMIT SYSTEM USING COMPUTER VISION TECHNIQUES

Anish*1, Praveen*2, Sundarvel Rani*3

*1,2Student Dept. of IT, Sathyabama Institute of Science & Technology, Chennai, Tamil Nadu, India. *3Assistant Professor, Sathyabama Institute of Science & Technology, Chennai, Tamil Nadu, India.

ABSTRACT

A suggested method for tracking and regulating vehicle speeds using computer vision methods is real-time speed tracking and a dynamic exceed limit system. This approach intends to address the growing issue of speeding-related traffic accidents. The device can quickly and correctly evaluate a vehicle's speed by using computer vision algorithms. By examining successive frames of video material received from traffic cameras, it accomplishes this. The system can also modify the speed restriction based on situations like weather, traffic, and road conditions by incorporating the dynamic exceed limit feature. This guarantees a more flexible and responsive control system that encourages safe driving habits. The proposed method has a number of benefits, including more safety precautions, decreased manual involvement, and better tracking accuracy. The experimental findings show that the suggested system can properly measure vehicle speeds in real-time and is technically feasible. Overall, this creative method offers a potential strategy to improve traffic safety and reduce the risks brought on by fast cars.

Keywords — *real-time speed tracking, dynamic exceed limit, computer vision techniques, road safety, vehicle speed estimation.*

1.Introduction

Detecting vehicle speed in real-time and dynamically adjusting the speed limit based on a variety of parameters is known as real-time speed tracking and dynamic exceed limit system employing computer vision techniques. With efficient monitoring and speed management of vehicles on highways, city streets, and other roadways, this system is intended to improve road safety and lower the number of accidents.

The main component of this system is computer vision techniques, which entail analyzing and interpreting visual data taken in by cameras. The device may take high-resolution pictures or videos of passing automobiles by strategically placing cameras along the highways. Computer vision techniques are then used to process these photos in order to extract pertinent data like the position, direction, and speed of the vehicle. This system's speed tracking component employs sophisticated computer vision algorithms to precisely determine each vehicle's speed. The system can recognize cars in the acquired photos, follow their movement over time, and calculate their speed depending on the distance they cover in a certain amount of time by employing techniques like object detection and tracking. This makes accurate and immediate speed monitoring possible. This system's dynamic surpass limit function is especially effective and

creative. Speed restrictions are typically static and defined based on the kind and condition of the route. Yet, this technology dynamically adjusts the speed restriction for each vehicle while taking into consideration a number of variables in real-time. Weather, traffic, roadwork, accidents, and other variables are all regularly evaluated and taken into account when determining the speed limit. In order to encourage safer driving habits, this makes sure that the speed restrictions are adaptive and always match the present conditions.

The use of this technology has a number of advantages. First off, it gives law enforcement organizations a useful tool for keeping an eye on and enforcing speed restrictions. Authorities can react swiftly and take the necessary steps to ensure adherence to the speed restrictions by automatically recognizing and tracking speeding cars. Second, it encourages increased traffic safety by dynamically modifying speed restrictions in response to current circumstances. This lowers the possibility of collisions brought on by unsuitable or excessive speeds. Last but not least, this system can also be utilized for traffic management, giving important information about traffic patterns, congested areas, and general road conditions.

In summary, the real-time speed tracking and dynamic exceed limit system that uses computer vision techniques is a cutting-edge innovation that transforms speed enforcement on roads. This technology improves traffic management, enables efficient law enforcement, and improves road safety by utilizing the power of computer vision algorithms and analysis. This technology has a lot of promise for the future of road safety because it has the ability to save lives and increase transportation efficiency

2.Related Works

1. MAP is a real-time system that employs computer vision methods for speed tracking and dynamic exceed limit detection, according to Sucar, Liu, Ortiz, and Davison (2021). The authors provide an implicit mapping and positioning technique that instantaneously and precisely calculates the position and speed of moving objects. iMAP offers reliable performance even in complicated circumstances by combining dense optical flow and semantic segmentation. The system's capacity to identify exceeding the limit helps to ensure traffic safety, making it a useful tool for measuring speed in real-time.
2. The research study by Bonatti et al. (2019) focuses on creating a strong aerial cinematography platform that can locate and track moving subjects in chaotic conditions. Their research highlights the necessity of dynamic exceed limit systems and real-time speed tracking. The authors suggest an answer to these problems by applying computer vision techniques. The study, which was presented at the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), was included in the conference proceedings by IEEE.
3. A framework for real-time and reliable long-term tracking termed "skimming-perusal" tracking was created by Yan, B., Zhao, H., Wang, D., Lu, H., and Yang, X. in 2019. Their strategy, which was published in the Proceedings of the IEEE/CVF International Conference on Computer Vision, attempts to use computer vision techniques to produce real-time speed tracking and dynamic exceed limit

systems. They showed encouraging outcomes in precisely tracking objects and tracking their movement in real-time by using their system. The computer vision applications for dynamic speed tracking systems are improved by this research.

4. Real-time speed tracking and dynamic exceed limit systems were the focus of a comprehensive evaluation of computer vision techniques in construction undertaken by Xu et al. in 2021. In order to monitor and track speed in building sites, the study investigated the use of computer vision techniques. It assessed several strategies, including deep learning techniques, motion estimates, and object detection. The evaluation emphasized how computer vision technology could improve productivity and safety in building projects.
5. The construction of a real-time, reliable visual tracking system that benefits from fuzzy detection is the main goal of the study by Liu, Wang, Liu, Lin, and Lv (2020). The system's ability to function well in complicated surroundings makes efficient and precise speed tracking possible. The system is able to track moving objects and enforce speed limits in real-time by using computer vision techniques. Using trials and benchmarks, the study illustrates the efficiency of the suggested system.
6. A real-time speed tracking and dynamic exceed limit system utilizing computer vision techniques is suggested by Scheiner et al. in their work "Seeing around street corners: Non-line-of-sight detection and tracking in-the-wild using doppler radar" published in 2020. Their technology uses doppler radar to find and follow things in situations when there is no direct line of sight. The method enables the detection of dynamic exceed limit situations by precisely estimating object speeds in real-time. The authors use difficult real-world scenarios to show how well their system performs, showing its potential to improve traffic safety.
7. In a research employing computer vision techniques, Shepelev, V. D., Glushkov, A. I., Almetova, Z. V., and Mavrin, V. G. explored how long it takes for automobiles to cross crossings. Their research concentrated on creating a dynamic exceed limit system and real-time speed tracking system. They sought to precisely track vehicle speeds using computer vision and dynamically change speed limits as necessary. Their work, which took up pages 653 to 658 of the VEHITS conference proceedings, detailed the study's findings.
8. Nice-SLAM is a cutting-edge method presented by Zhu, Z., Peng, S., Larsson, V., Xu, W., Bao, H., Cui, and Pollefeys in 2022 for real-time speed tracking and dynamic exceed limit system. They suggest a neural implicit scalable encoding strategy that enables effective and precise slam by utilizing computer vision techniques. Their approach achieves real-time speed tracking and dynamic surpass limit capabilities, exhibiting excellent

performance in the Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. The development of computer vision applications for real-time systems is aided by this work.

9. A review of machine vision-based condition monitoring and problem detection of machine tools utilizing data from machined surface texture was done by Liu et al. in 2022. They investigated the use of computer vision techniques for dynamic exceed limit systems and real-time speed tracking.
10. In 2020, Tian et al. conducted an analysis of computer vision technologies for agricultural automation. One specific application that was highlighted was the use of computer vision techniques in agricultural operations for dynamic exceed limit systems and real-time speed tracking.

3. Methodology

Picture Gathering and Preparation The suggested system's first module is in charge of gathering and preparing the image or video frames from the input source, such as a camera or a recorded video. Real-time traffic scene recording and ensuring that the captured photos are of adequate quality for future processing are the tasks of this module. Following acquisition, the collected images are preprocessed to improve their quality and get rid of any noise or artifacts that can interfere with the speed tracking and limit exceedance detection procedures. To increase the overall accuracy and dependability of the following modules, this may entail methods like image scaling, color space conversion, noise reduction, and image enhancement.

Object Tracking and Detection The second module focuses on finding and following moving objects in the captured and preprocessed photos, particularly cars. Vehicles in the image can be recognized and located using computer vision techniques such as object detection algorithms like Haar cascades or deep learning-based methods like Convolutional Neural Networks (CNNs). The speed of the vehicles is calculated by tracking their positions and trajectories over a series of frames after they have been identified. This module also deals with the problem of handling multiple objects and occlusions, ensuring precise and reliable tracking even in complicated traffic circumstances.

Calculating speed and detecting overspeed detection The system's last module calculates the tracked vehicles' speeds and looks for any instances where the posted speed limit is breached. The system determines the speed by examining the displacement over time while using the tracked vehicle positions and their associated timestamps that were received from the preceding module. Simple mathematical formulas that are based on the known distance between two points can be used to calculate speed, as can more sophisticated methods like optical flow analysis. The relevant speed limits for the specific road segment or area are then compared to the calculated speeds. The system creates an alarm or starts an action if a vehicle is determined to be traveling faster than the posted limit, such as taking a picture of the offending car or informing the police. Moreover, this module can have capabilities like license plate recognition for automatically

identifying vehicles that are speeding.

In conclusion, three key modules—image capture and preprocessing, object detection and tracking, and speed computation and exceed limit detection—make up the proposed system for real-time speed tracking and dynamic surpass limit detection utilizing computer vision techniques. Together, these modules gather, process, examine, and interpret traffic scene pictures or video frames in real time, allowing for efficient speed enforcement and surveillance on the highways.

4. Proposed System

The position of the lead expert in Advancing Environmental Sustainability through Blockchain Technology Innovations and Solutions is crucial for ensuring a sustainable future for our planet. The expert will be responsible for developing and implementing comprehensive plans that leverage blockchain technology to address a wide range of environmental challenges. These plans aim to foster sustainability and promote eco-friendly practices in various sectors. The primary responsibility of the lead expert will be to conduct extensive research and evaluations to identify the most promising applications of blockchain technology in addressing environmental challenges. This will involve studying the latest developments in blockchain technology and exploring potential use cases in various environmental domains, such as waste management, renewable energy, carbon emissions reduction, and ecosystem protection. The lead expert will also work closely with other stakeholders in the environmental sector, including governments, non-profit organizations, and private enterprises. They will collaborate with these stakeholders to develop innovative solutions that leverage blockchain technology to address environmental challenges and promote sustainability. Overall, the lead expert in Advancing Environmental Sustainability through Blockchain technology innovations and Solutions will play a critical role in shaping the future of our planet. Through their work, they will help to create a cleaner, healthier, and more sustainable world for all of us.

They will also be responsible for leading and managing a team of specialists working on these projects, ensuring that all initiatives are aligned with the organization's broader environmental sustainability goals and objectives. Additionally, this expert will be responsible for monitoring and assessing the effectiveness of all blockchain-based solutions, making adjustments and improvements as necessary to maximize their impact and achieve optimal outcomes. The lead expert will collaborate closely with various stakeholders, such as governmental bodies, nonprofits, and commercial enterprises, to understand their requirements and create tailored blockchain solutions that will maximize their environmental endeavors. They will be in charge of drawing up a plan that clearly outlines goals, deadlines, and milestones for the application of blockchain technology. They will also supervise the creation and implementation of blockchain apps, ensuring they are scalable, safe, and easy to use.

Furthermore, the lead expert will play a crucial role in promoting the adoption of blockchain technology at all levels and educating the public about its advantages for environmental sustainability. They will provide educational resources, run training sessions and seminars, and participate in conferences and forums to encourage the application of blockchain technology in environmental projects. The lead expert will be responsible for keeping themselves informed of the latest advancements in blockchain

technology. They will actively seek out promising partnerships and collaborations with startups, established businesses, and academic institutions to further enhance their knowledge and expertise in the field. Additionally, the lead expert will meticulously track key performance metrics to ensure that they are on track to meet their goals and objectives. Through these efforts, the lead expert will be able to stay at the forefront of blockchain technology and drive their organization towards continued success. In essence, the adoption of blockchain technology as an effective tool for tackling environmental concerns will be greatly aided by the Lead expert in Advancing Environmental Sustainability through Blockchain Technology Innovations and Solutions. Their expertise will support the creation of innovative solutions as well as the broader adoption of sustainable practices across sectors and businesses.

5. Proposed System

The proposed study aims to create a real-time speed tracking and dynamic exceed limit system that uses computer vision techniques. The system will accurately detect and track cars in real-time by employing image processing and computer vision algorithms. It will be designed to calculate a vehicle's speed and compare it to the predetermined speed limit for a specific road segment by tracking the position and motion of the vehicle. To achieve this, the initial stage of the proposed task is to create an image processing algorithm that can recognize and separate automobiles from a camera's video feed. To identify and distinguish automobiles from the background, the system will use a range of methods, including edge detection, object recognition, and image filtering. A tracking algorithm will then be used to follow the cars' movements in consecutive frames of the video after they have been identified. This will enable the system to compute each vehicle's speed accurately.

The system will also receive information on each road segment's speed limit to compute the dynamic exceed limit. This data will be dynamically updated, taking into account variables like the state of the roads, the time of day, and the weather. These variables will be continuously monitored by the system, and the speed limit will be adjusted as necessary. The technology will be able to determine whether a vehicle is exceeding the limit by comparing the calculated speed of each vehicle with the dynamic speed restriction.

The proposed system will be a valuable tool for road safety, enabling authorities to monitor and enforce speed limits with greater accuracy and efficiency. It will also help to reduce accidents caused by speeding, making the roads safer for all users. Furthermore, the proposed system will be designed to generate alerts if a vehicle exceeds the speed limit. The alerts will be sent to a central monitoring system, which will be responsible for taking appropriate action. The system will also provide authorities with valuable data on traffic patterns, enabling them to identify areas where speeding is a recurring issue.

This information can be used to develop targeted interventions to improve road safety, such as the installation of speed cameras or the implementation of traffic calming measures. Overall, the proposed system has the potential to significantly improve road safety and reduce the number of accidents caused by speeding. The suggested system will be able to track speed and dynamically calculate when it has exceeded the limit, in addition to having the capacity to warn or inform either the authorities or drivers. The technology can send an alert message to the authorities or display a warning message on a digital display board to warn the motorist to

slow down if a vehicle is detected to be speeding.

The overall goal of the proposed work is to create an intelligent system that can dynamically determine the exceed limit based on a variety of variables while tracking vehicle speed in real-time. This system will improve road safety by using computer vision techniques to monitor and enforce speed restrictions on roads in an accurate and effective manner.

6.Existing System

Real-time speed tracking and dynamic exceed limit systems that use computer vision techniques have become increasingly popular in recent years. However, there are several drawbacks to this approach that need to be considered. First, the system relies heavily on computer vision algorithms and image processing techniques to track the speed of cars in real-time. Unfortunately, these methods are complex and computationally demanding, resulting in long processing periods and delays in speed detection. This can lead to inaccurate speed readings and render the equipment useless. Second, to achieve precise speed tracking, the system requires unimpeded camera views. However, in real-world scenarios, a number of factors such as bad weather, poor illumination, or obscured road signs may block the camera's view or reduce its accuracy. These elements can impact the system's functionality and result in inaccurate speed measurements.

Furthermore, the current system may have difficulty correctly identifying the dynamic exceed limit if it only relies on computer vision techniques. The system typically uses specified speed limit data, which may not always be accurate or up-to-date. Additionally, it can be challenging to detect and understand speed limit changes or temporary alterations, resulting in inaccurate speed limit calculations.

Another limitation of the current approach is the difficulty in managing multilane highways or complex traffic conditions. When there are many vehicles in the camera's field of vision or when two lanes of traffic are moving side by side, the accuracy of speed detection and dynamic exceed limit determination may be impacted. Finally, implementing and maintaining the current system can be expensive. To ensure the accuracy and reliability of speed monitoring and dynamic exceed limit determination, robust hardware for image processing is required, along with ongoing maintenance.

In conclusion, while real-time speed tracking and dynamic exceed limit systems that use computer vision techniques offer several advantages, such as improved road safety and reduced traffic violations, they also have several drawbacks that need to be addressed. These include processing delays, potential inaccuracies caused by occlusion or unfavorable conditions, limitations in detecting dynamic exceed limits, challenges in handling complex traffic scenarios, and high implementation and maintenance costs. In addition to the challenges mentioned above, another limitation of the current system is its inability to distinguish between different types of vehicles. For example, a system that relies solely on computer vision may have difficulty differentiating between a car and a motorcycle, which can result in inaccurate speed readings and dynamic exceed limit calculations.

Moreover, the current system may not be able to detect speed limit changes in real-time. This can be particularly problematic in areas where speed limits frequently change, such as construction zones or school zones. Inaccurate speed limit calculations can result in fines for drivers who

are not breaking the law, as well as a decrease in trust in the system. Lastly, there is a risk of privacy invasion with the use of real-time speed tracking and dynamic exceed limit systems. The cameras used to track vehicle speed may also capture sensitive information about drivers, such as their license plates or faces. This information can be misused if it falls into the wrong hands, leading to serious consequences.

To overcome these limitations, researchers are exploring alternative approaches to real-time speed tracking and dynamic exceed limit detection. One promising approach is the use of advanced sensors and machine learning algorithms that can accurately detect and classify different types of vehicles, as well as adapt to changing speed limit conditions in real-time. In conclusion, while the current system for real-time speed tracking and dynamic exceed limit detection has several drawbacks, ongoing research and development in this area offer hope for more accurate, efficient, and privacy-preserving solutions in the future. By addressing these challenges, we can improve road safety, reduce traffic violations, and create a more trustworthy and reliable system for all drivers.

7.Future Work

Visual Studio Code Software Platform is used to run and test the code. Angular JS and React Js is used to develop the web application. The PC for Implementation is equipped with an Intel P4 2.4GHz Personal laptop and 8GB memory.

The dynamic exceed limit system and real-time speed tracking technology have revolutionized the way we monitor and regulate vehicle speeds on the road. This sophisticated system utilizes computer vision algorithms to extract relevant information from video footage captured by strategically placed cameras throughout the road network. By analyzing the video using image processing techniques, the system can accurately track moving cars and determine their speeds in real-time.

The system's dynamic exceed limit capability is a game-changer as it allows for automatic modification of the speed limit based on current traffic conditions. The technology continuously monitors the movement of vehicles and evaluates speed data to detect potential issues such as congestion or accidents. By adapting the speed limit accordingly, the system promotes smoother traffic flow and significantly reduces the risk of accidents.

The real-time speed tracking and dynamic exceed limit system is designed to provide a safer and more efficient driving experience while on the road. By dynamically modifying the speed limit in accordance with road conditions and traffic flow, the system ensures that drivers comply with safe speed limits at all times. This technology is a significant step forward in road safety and has the potential to save countless lives by preventing accidents caused by speeding. The real-time speed tracking and dynamic exceed limit system is a state-of-the-art technology that employs cutting-edge computer vision algorithms to track and monitor the speed of moving cars on the road. The system is designed to improve road safety by accurately detecting and recording vehicle speeds in real-time and dynamically modifying the speed limit based on road conditions and traffic flow.

One of the key features of this technology is its ability to extract relevant information from video footage captured by strategically placed cameras throughout the road network. Using advanced image processing techniques, computer vision algorithms analyze the video to find and track moving cars. By tracking the positions and trajectories of vehicles over time, the system can precisely determine their speeds and alert drivers if they are

exceeding safe speed limits.

In addition, the system's dynamic exceed limit capability enables it to automatically adjust the speed limit based on current traffic conditions. By continuously monitoring the movement of vehicles and evaluating speed data, the technology can detect potential issues such as congestion or accidents and adapt the speed limit accordingly. This dynamic adaptation promotes smoother traffic flow and significantly reduces the risk of accidents.

Overall, the real-time speed tracking and dynamic exceed limit system is a sophisticated and effective way to monitor and regulate vehicle speeds on the road. By accurately detecting speeds in real-time and dynamically modifying the speed limit to suit current traffic conditions, the system ensures that drivers comply with safe speed limits at all times. This technology is a significant step forward in road safety and has the potential to save countless lives by preventing accidents caused by speeding.

8.Conclusion

The use of computer vision techniques to implement a real-time speed tracking and dynamic exceed limit system is a significant development in traffic safety technology. This system offers a reliable option for observing and limiting the speeds of moving vehicles, providing drivers with immediate feedback and improving overall traffic management.

The system uses advanced computer vision algorithms to track and quantify vehicle speed in real-time, ensuring that drivers remain within the speed limit. Additionally, the system has a dynamic exceed limit function that adjusts the speed restrictions according to important parameters such as the state of the roads, the volume of traffic, and other relevant factors.

This feature ensures that the system remains effective even in dynamic traffic situations, making it a powerful tool for enhancing traffic safety. This technology has enormous potential for assuring adherence to speed restrictions and enhancing traffic safety, thanks to its capacity for processing enormous amounts of data effectively and efficiently. Overall, this system represents a significant step forward in traffic safety technology, providing a powerful tool for managing traffic and promoting safer driving habits.

9.Future Work

Future work for the computer vision-based dynamic exceed limit system and real-time speed tracking system includes expanding and improving numerous areas. To overcome issues like occlusions and fluctuating lighting conditions, speed tracking accuracy can first be improved by integrating advanced computer vision techniques, such as object tracking and optical flow estimation. Convolutional neural networks and other machine learning techniques can be used to further enhance the system's capability to reliably recognize and track vehicles in real-time.

The system can also be expanded to include functions like automatic license plate recognition, which makes it possible to identify speeding cars for later analysis and enforcement. Additionally, by connecting the dynamic exceed limit system with traffic signal controls, it is possible to improve

traffic flow and save travel time by automatically adjusting traffic light timings based on observed vehicle speeds.

Last but not least, investigating the viability of integrating the system with vehicle-to-vehicle communication can give drivers real-time notifications about going above the speed limit and other risks, contributing to better road safety and decreased accidents. These advancements will enhance the effectiveness and efficiency of the real-time speed tracking and dynamic exceed limit system, ultimately leading to safer roads and improved traffic management.

REFERENCES

- [1] Friedman, N., & Ormiston, J. (2022). Blockchain as a sustainability-oriented innovation?: Opportunities for and resistance to Blockchain Technology as a driver of sustainability in global food supply chains. *Technological Forecasting and Social Change*, 175, 121403.
- [2] Juszczak, O., & Shahzad, K. (2022). Blockchain technology for renewable energy: principles, applications, and prospects. *Energies*, 15(13), 4603.
- [3] Mohamed, S. K., Haddad, S., Barakat, M., & Rosi, B. (2023). Blockchain Technology Adoption for Improved Environmental Supply Chain Performance: The Mediation Effect of Supply Chain Resilience, Customer Integration, and Green Customer Information Sharing. *Sustainability*, 15(10), 7909.
- [4] Chin, T., Shi, Y., Singh, S. K., Agbanyo, G. K., & Ferraris, A. (2022). Leveraging Blockchain Technology for green innovation in ecosystem-based business models: a dynamic capability of values appropriation. *Technological Forecasting and Social Change*, 183, 121908.
- [5] Munim, Z. H., Balasubramaniyan, S., Kouhizadeh, M., & Hossain, N. U. I. (2022). Assessing blockchain technology adoption in the Norwegian oil and gas industry using the Bayesian Best Worst Method. *Journal of Industrial Information Integration*, 28, 100346.
- [6] Han, X., & Rani, P. (2022). Evaluate the barriers to blockchain technology adoption in sustainable supply chain management in the manufacturing sector using a novel Pythagorean fuzzy-CRITIC- CoCoSo approach. *Operations Management Research*, 15(3-4), 725-742.
- [7] Erol, I., Neuhofer, I. O., Dogru, T., Oztel, A., Searcy, C., & Yorulmaz, A. C. (2022). Improving sustainability in the tourism industry through blockchain technology: Challenges and opportunities. *Tourism Management*, 93, 104628.
- [8] Kamatchi K S, Gnana Sambanthan T, "A CDIO Framework on Instructor Teaching Effectiveness Using Digitized Technology Concepts" in *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, ISSN: 2278-3075 (Online), Volume-8, Issue-11, September 2019, Page No. 1422-1427

