**LITERATURE SURVEY**

**Intelligent Vehicle Surveillance and Speed Enforcement System**

The "Intelligent Vehicle Monitoring and Speed Enforcement System" project is a cutting-edge initiative aimed at revolutionizing traffic management and road safety. This project seeks to address these issues by developing a machine learning algorithm capable of identifying vehicles that exceed the speed limit. The project involves two pivotal stages: vehicle detection and tracking. These stages enable us to not only classify vehicle types and their respective speeds but also accurately count the number of vehicles passing through a designated area and License plate recognition of vehicle.

**SCOPE:**

The scope of the project is to design, develop, and implement an innovative and economic video-based traffic surveillance system with image processing capabilities for speed determination and traffic control.

* **Vehicle Counting and unique id generation**: Develop and implement systems capable of accurately counting the number of vehicles traversing through designated regions. and generating a unique id for vehicles.
* **License Plate Recognition of the vehicle**: Design and seamlessly integrate License Plate Recognition (LPR) technology, enabling the capture and recognition of vehicle license plates within the area.
* **Speed Estimation using Euclidean distance**: Develop advanced algorithms and hardware solutions to precisely estimate the speed of vehicles as they pass through designated areas.
* **Classification of type of vehicle:** Implement a classification system capable of categorizing vehicles into distinct groups such as cars, trucks, motorcycles, etc., based on their size and type of vehicle.
* **Data Storage and Export in Excel sheet:** Incorporate a feature to export this stored data to Excel format, ensuring efficient record-keeping and facilitating in-depth data analysis**.Top of Form**

**SELECTION STRATEGY**:

* **Deep Learning and YOLO Algorithms:** To delve into deep learning and YOLO algorithms relevant to your Intelligent Vehicle Surveillance and Speed Enforcement System project, explore online resources such as research papers, blogs, and tutorials.
* **Participate in Online Communities:** Engage with online communities and forums dedicated to intelligent vehicle surveillance, traffic management, and enforcement systems. These platforms are valuable for gaining insights and sharing knowledge specific to your project.
* **Leverage Library Resources:** For data analysis and manipulation, leverage Python libraries such as Pandas and NumPy. Refer to official documentation for these libraries to understand their functionalities and usage. Investigate code examples and tutorials illustrating the use of Pandas and NumPy for tasks relevant to your project.
* **Features and Functionality:** Develop a cost-effective video-based traffic surveillance system using image processing. Improve speed measurement accuracy and reduce maintenance requirements compared to existing systems. Implement a reliable and scalable infrastructure for enforcing speed limits and enhancing traffic control.Top of Form

**DATA EXTRACTION**:

In an intelligence and surveillance-based system for traffic monitoring and speed enforcement, data is primarily extracted from various sources within the surveillance infrastructure. Here are the key sources from which data is typically extracted:

* **Manual Inputs:** In certain scenarios, manual data input may also be necessary. For example, law enforcement personnel may input specific information about incidents or accidents into the system.
* **Traffic cameras**: It is also referred as traffic surveillance cameras or traffic CCTV. They are used to monitor traffic flow, congestion and accidents both manually (visual inspection by a human operator) or automatically. In most cases, these are fixed cameras located far from the traffic flow, infrastructure- or drone-based.

**ORGANISATION:**

**Data Collection**:

* Set up cameras or sensors at specific locations to capture vehicle speeds.
* Collect data on vehicle speeds and corresponding timestamps.

**Data Preprocessing**:

* Process the speed data, including removing outliers and ensuring data quality.
* Split the data into training and testing/validation sets if you're developing a machine learning model for enforcement.

**Machine Learning Model**:

* Train a machine learning model (e.g., regression or classification) to predict vehicle speeds based on the available features (e.g., vehicle type, road conditions, time of day).
* Alternatively, you can use rule-based systems for simple speed enforcement.

**Integration**:

* Integrate the trained model or speed enforcement system into the infrastructure at the target locations.
* Set up cameras or sensors to capture vehicle speeds in real-time.

**Data Storage and Reporting**:

* Store records of speeding violations for future reference and reporting purposes.

**SYENTHESIS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.NO** | Name | Year | Authors | Algorithm used |
| 1 | A survey of moving object detection methods:A practical perspective | June 2022 | Xinyue Zhao, Guangli Wang, Zaixing He | Object Detection Algorithm |
| 2 | Smart Traffic Monitoring System using YOLO and Deep Learning Techniques | April 2023 | Akhil Reddy Kalva, Jyoti Swarup, B. Bharathi | YOLO V8 and Deep Sort Algorithm |
| 3 | An Adaptive Video-based Vehicle Detection, Classification, Counting, and Speed measurement System. | Jan 2019 | Amit Ghosh, MD.  shahinuzzaman,  Hamudi Hasan Sonet, Swakkhar Shatabda | Background  S ubtraction  Mo G2 algorithm |
| 4 | Automatic number plate recognition using deep learning | October 2021 | V Ganaprakash,  N Kanthimathi,  N Saranya. | YOLO V8 |
| 5 | Vision-based vehicle speed estimation: A survey | May 2021 | David Fernandez Liorca, Antonio Hernandez,  IvanGarcia Daza | Motion tracking |

**IDENTIFY GAPS:**

To further improve the system's capabilities and extend its potential impact, several future enhancements can be considered

* **Multi-Camera Integration**: Integrating data from multiple cameras to create a comprehensive traffic monitoring network for larger areas and better traffic flow analysis.
* **Machine Learning**: Incorporating machine learning algorithms to improve object detection accuracy and handle various road and weather conditions more effectively.
* **Violation Detection**: Identifying vehicles exceeding speed limits based on pre-defined thresholds.
* **Real-time Monitoring**: Displaying real-time speed and violation information to traffic control centre
* **Alert System**: Notifying authorities of speed violations for immediate action.

**CRITICAL EVALUATION**:

* Check the qualifications and expertise of the system developers.
* Consider the reliability of information sources, like government or trusted research organizations.
* Evaluate the transparency of the research methods used in the project.
* Listen to feedback from users who have practical experience with the system.
* Ensure the system complies with traffic rules and respects privacy laws.
* Pay attention to user reviews and opinions about the system's functionality and usability.

**DISCUSSION:**

According to existing system research, there are several drawbacks:

**High Cost**: Both intrusive and non-intrusive sensors can be expensive to install and maintain. The initial setup costs for intrusive sensors involve complex installations in the road surface, while non-intrusive sensors, such as laser meters and doppler radars, often come with higher price tags.

• **Line of Sight Requirement**: Intrusive sensors often require a direct line of sight between the sensor and the vehicle, limiting their flexibility for installation in various road layouts.

• **Lack of Scalability**: Expanding the existing system to cover a larger area or more lanes can be challenging and costly, especially for non-intrusive sensors.

Proposed System to overcome the existing system drawbacks:

The system comprises a camera that captures the traffic scene, and a computer processes the video stream using the YOLO v8 object detection model. The YOLO v8 model is fine-tuned on a large dataset of vehicle images to accurately detect, classify, count, and estimate the speed of vehicles in the scene, License plate recognition and data storage of vehicles. The Proposed system uses a single-camera setup to capture the traffic scene, which makes it cost-effective. It is designed to be efficient and capable of processing the video stream in real life, which makes it suitable for real-time applications.

**CONCLUSION:**

A real-time traffic monitoring system is proposed, utilizing a virtual detection zone and YOLO v8, to enhance the efficiency of vehicle counting, detection, and classification. Additionally, the distance and time traveled by each vehicle are utilized to estimate their speed. YOLO v8 demonstrates superior accuracy in both classification and detection when compared to other algorithms, and deep sort is employed alongside YOLO v8 to track vehicles effectively. As a result, this method can be effectively applied to real-life scenarios for vehicle counting, speed estimation, and classification of vehicles, license plate recognition, data storage of all the vehicle information in Excel.

**CITATION AND REFERENCING :**

1. Akhil Reddy Kalva, Jyothi Swarup Chelluboina, B. Bharathi.” Smart Traffic Monitoring System using YOLO and Deep Learning Techniques”. 2023 7th International Conference on Trends in Electronics and Informatics (ICOEI).
2. Madasu, Vamsi Krishna, and Madasu Hanmandlu. "Estimation of vehicle speed by motion tracking on image sequences."In Intelligent Vehicles Symposium (IV), 2010 IEEE, pp. 185-190. IEEE, 2010.
3. Amit Ghosh, MD. shahinuzzaman, Hamudi Hasan Sonet, Swakkhar Shatabda. “An Adaptive Video-based Vehicle Detection, Classification, Counting, and Speed-measurement System for Real-time Traffic Data Collection”.2019 IEEE Region 10 Symposium (TENSYMP).
4. Mahmudol H. Tusar, Md. T. Bhuiya, Md. S. Hossain, Anika Tabassum, Riasat Khan, "Real Time Bangla License Plate Recognition with Deep Learning Techniques", *2022 IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAIET)*, pp.1-6, 2022.