VEHICLE GRIEVANCE HANDLING

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ABSTRACT

In this vehicle grievance handling our cutting-edge traffic safety monitoring system uses object detection, machine learning, and YOLOv3 to improve road safety. It can distinguish between motorbikes and non-helmet riders, recognize triple riding, and keep an eye out for fast-moving scars. This technique greatly lessens the need for physical enforcement by emphasizing the usage of helmets, speed compliance, and safe riding habits. It helps law enforcement encourage safer driving practices and lessen accident-related injuries, especially brain injuries, by offering real-time insights and actions, so increasing overall traffic safety.

Keyword: Object detection, Machine learning, YOLOv3, Traffic surveillance, Helmet detection.

I. INTRODUCTION

India is seeing a startling increase in traffic fatalities, which is being made worse by the country's fast urbanization, lax traffic laws, and general disdain for safety precautions. Problems such as triple riding exacerbate these risks and provide serious obstacles to road safety. The study suggests incorporating automated vehicle speed detection technology in order to address these issues. The goal of this project is to create a reliable system that can deliver data in real-time on traffic infractions like speeding, triple riding, and not wearing a helmet. The initiative aims to improve overall road safety measures throughout India and lower the number of fatalities from traffic crashes by utilizing automation and machine learning.

Despite a high rate of non-compliance among cyclists, helmets are proven to be helpful in India in preventing major injuries sustained in accidents. High rates of road fatalities are a result of careless driving, increasing urbanization, and disdain for safety precautions like seat belts and helmets. A comprehensive traffic safety monitoring system that makes use of cutting-edge technologies like object identification, machine learning, and YOLOv3 is introduced in order to address these issues. the accurately detecting infractions including speeding, triple riding, and riding a motorcycle without a helmet, this technology seeks to police restrictions. By using clever algorithms and visual analysis, it reduces the need for human interaction while boosting the capabilities of real-time surveillance. The system intends to support law enforcement activities and improve road safety standards by highlighting the use of helmets and safe riding behaviors. Incorporating technology enhances the effectiveness of law enforcement while also encouraging adherence to traffic regulations. Overall, the study promotes practical actions that will encourage following safety rules and lessen the dangers of breaking them while driving.

II. LITERATURE SURVEY

With the use of a unique CNN architecture for helmet recognition and YOLOv3 for initial rider detection. This study presents a reliable framework for identifying riders without helmets. A range of traffic videos are used to evaluate the model's effectiveness in comparison to existing CNN-based methods, showing promising results.[1]

The study highlights how important it is for motorcycle riders to wear helmets in order to ensure their safety, especially in heavily populated areas like India where motorbikes are common. A sizeable percentage of riders disobey helmet laws, which raises the possibility of serious injury in collisions.[2]

In order to guarantee helmet usage among maintenance staff, this study offers an improved YOLOv5s helmet detection algorithm. The algorithm creates an intelligent monitoring system when it is implemented on edge-end devices. One of the main improvements is that the convolutional block attention module (CBAM) has been integrated into the YOLOv5's backbone to enhance feature extraction and increase the accuracy of helmet recognition.[3]

Using facial structures for authentication in a variety of applications, face recognition is a crucial component of security systems. The two main detection techniques examined in this paper are the convolutional neural network (CNN) and the Haar cascade. While CNN delivers higher accuracy but requires more GPU resources, Haar Cascade offers quick, real-time detection; hence, for some client applications, such as mobile and Raspberry Pi devices, Haar Cascade is preferred.[4]

The work provides an easy-to-use OpenCV and Python technique for number plate recognition. The input image must be converted to grayscale, noise must be removed using a bilateral filter, and Canny edge detection must be utilized in order to locate plate edges. The characters on the plate are then identified using PyTesseract's optical character recognition (OCR) technology. By utilizing widely available image processing and optical character recognition libraries and techniques, this system provides an effective way to recognize license plates.[5]

This work introduces YOLO, a unique approach to object detection that uses entire images to generate class probabilities and geographically separated bounding boxes by treating the task as a regression problem. YOLO functions as a single neural network and predicts these parameters rapidly, reaching real-time processing at 45 frames per second for the conventional model and 155 frames per second for Fast YOLO. It does this by using double the map of current real-time detectors.[6]

A deep convolutional neural network-based image processing system tackles the problem of parking scarcity in cities. The technology provides a solution when sensor-based solutions are impracticable by identifying open street parking spaces by analyzing frames from roadside cameras.[7]

The growing number of people owning cars, particularly in cities, has made traffic more congested and has resulted in more infractions, accidents, and fatalities. Automated traffic infraction detection technologies have become essential in order to handle this. When this system notices infractions, including signal violations, it swiftly tells the parties involved.[8]

With continuous research and a plethora of applications targeted at lowering reliance on human labor and yielding benefits, the Internet of Things (IoT) presents enormous implementation opportunities. The demand for parking spots rises as urban populations grow and become more dependent on transportation.[9]

However, manual parking systems are still frequently utilized in public areas, which causes traffic bottlenecks and security risks. To address this, a smart outdoor parking system with weighbridge load sensors and Internet of Things integration can offer prompt, adaptable, secure, and well-organized parking choices, therefore decreasing traffic and enhancing public well-being. The technique runs at 37.8 frames per second and achieves 90% accuracy using K-means clustering and deep learning. Training entails tweaking the size of the input image and fine-tuning optimizers and hyperparameters. The system's camera integration allows for real-time helmet compliance verification, picture detection, video analysis, and live monitoring.[10]

III. METHODOLOGY

The systematic and disciplined approach used to plan, organize, carry out, and assess projects or research is referred to as methodology. It includes all of the procedures, tactics, and methods used to accomplish a project's or study's goals. In order to guarantee the validity, repeatability, and reliability of the results acquired, methodology is essential. Researchers and project managers can create a framework that improves the rigor and integrity of their work by clearly outlining their procedures. This will allow for meaningful analysis and interpretation of the outcomes.

3.1 SYSTEM DESIGN AND ARCHITECTURE:

In order to include modern technology like object identification and machine learning algorithms, the traffic safety monitoring system is built with a multi-layered architecture. The figure 1 describe system architecture:

High-definition cameras placed in strategic locations to monitor important thoroughfares and intersections. Effective protocols for data transmission that guarantee the central processing unit receives visual feeds in real time. robust hardware equipped to execute machine learning models for object detection and speed measurement, such as YOLOv3. Software specifically designed to handle object detection, speed computation, violation detection, and video analysis.

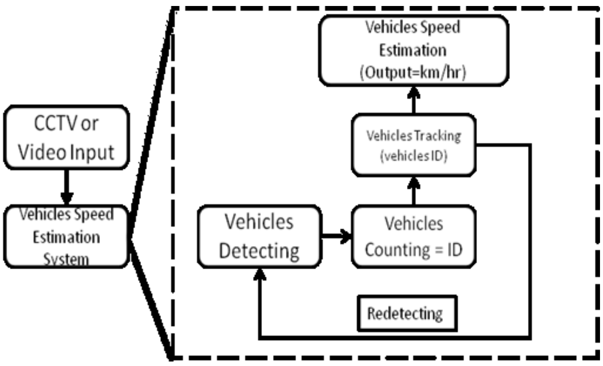

Figure 3.1.1: Architecture Diagram

1. Object Detection and Recognition

using YOLOv3 to detect objects in real-time, such as cars, bikes, pedestrians, and helmets. YOLOv3 was trained and adjusted using a variety of datasets to attain a high degree of accuracy in detecting traffic infractions like speeding, riding in threes, and riding without a helmet. Algorithms are optimized to reduce false positives and negatives, guaranteeing accurate item identification and detection. Figure 2 describe the object detection.

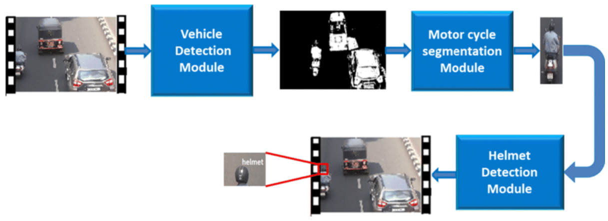

Figure 3.1.2: Object Detection

3.2 DATA COLLECTION AND PROCESSING:

Continuous video stream analysis is done to retrieve pertinent data, like rider count, vehicle speeds, and helmet usage. Effective database systems are used for the storage and organizing of gathered data, making it easier for analysis and retrieval. application of real-time processing methods to manage incoming data streams and cause law enforcement to receive notifications right away.

1. Implementation and Deployment

In order to assess performance and pinpoint possible enhancements, the system is first deployed and tested in a few high-risk areas. The system will be gradually expanded to cover larger geographic areas in response to feedback from stakeholders and pilot results. cooperation with local government to incorporate the technology into the structures currently in place for law enforcement and traffic management.

3.3 DATASET USED:

1.Helmet Use Data: Pictures or recordings of motorcycle riders wearing and not wearing helmets comprise the Helmet Use Data. The YOLOv3 model would be trained with this data in order to identify helmet wear.

2.Vehicle Speed Data: Information gathered from systems or speed detection devices that track moving cars' speeds. Radar speed guns, speed sensors, or video with speed annotations could all fall under this category.

3.Triple Ride Detection Data: Pictures or videos that display the number of motorcyclists. This information aids the model in detecting situations in which two or more persons are riding a single motorcycle.

4.Traffic Violation Data: An assortment of captioned photos or films showing different types of traffic infractions, like speeding, riding in threes, and helmetlessness. The type of violation present in each case would be indicated by annotations added to this dataset.

5.General Traffic Surveillance Data: Broadcast video feeds or massive photo collections from traffic cameras that record a variety of roadside situations, such as crossroads, freeways, and city streets, comprise general traffic surveillance data. The overall object detection duties are supported by this data.

3.4 DATA PRE PROCESSING:

1.Data Gathering: Collect pictures and videos from additional sources, such as traffic cameras.

2.Data Purification: Delete files that are incomplete or corrupted. Remove information that isn't relevant.

3.Annotation of Data: Define boundaries encircling riders, motorcycles, and headgear. Put a label (helmet, no helmet, single rider, triple riders, etc.) on each bounding box.

4.Preprocessing of Images and Videos: Resize pictures to a standard dimension. Normalize the values of the pixels. Perform data augmentation (rotate, flip, crop, etc.).

5.Splitting Datasets: Sort the data into test, validation, and training sets.

6.Formatting of Data: Transform annotations into a YOLOv3-compatible format.

7.Managing Data Inequalities: If necessary, adjust the dataset by oversampling or minimizing the classes.

8.Processing Temporal Data (for videos): Take out frames on a consistent basis. Make the necessary annotations to the frames.

3.5 Algorithm Used

1. YOLOv3 Algorithm:

The state-of-the-art object detection algorithm known as YOLOv3 (You Only Look Once, Version 3) is well-known for its quick and precise object identification in photos and videos. Created as an advancement over earlier versions, figure 3 describe, YOLOv3 processes incoming photos by splitting them into a grid of cells using a deep convolutional neural network architecture that is mainly based on Darknet. Bounding boxes and corresponding confidence ratings are simultaneously predicted for many classes by each cell. YOLOv3 can recognize objects across a range of scales and aspect ratios with efficiency thanks to this method. The approach combines feature maps from different network layers by integrating feature pyramid network (FPN) algorithms, which allows for reliable object detection at several resolutions. In addition, YOLOv3 employs minimal suppression (NMS) to filter redundant detections and save just the most reliable predictions, as well as anchor boxes to enhance bounding box predictions. YOLOv3 is frequently used in applications requiring real-time object detection due to its balance of speed and accuracy. These applications include automated driving, security cameras, and analysis of footage for traffic monitoring and safety enhancement.

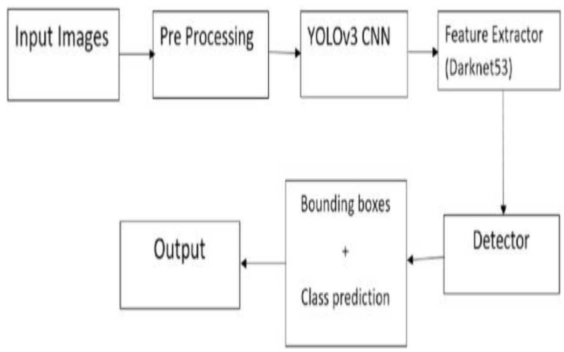

Figure3.3.1: Flow Chart for a Yolov3 Object Detection

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 07 | July - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

YOLOv3 algorithm:

1. **Input:** Image input is accepted by YOLOv3.
2. **Feature Extraction:** Feature extraction involves running the input image through several convolutional layers in order to extract its features. Hierarchical representations of the image are captured by these layers.
3. **Multi-scale Detection**: YOLOv3 uses feature mappings from various network layers to anticipate objects at three distinct scales. This aids in the efficient detection of items of different sizes.
4. **Bounding Box Prediction:** YOLOv3 makes bounding box predictions for every grid cell in the feature map. The width, height, confidence score, and center coordinates of each bounding box are used to characterize it. By using anchor boxes, bounding box predictions become more accurate for a variety of object sizes and forms.
5. **Class Prediction**: YOLOv3 additionally uses softmax activation to forecast the likelihood of each class for each bounding box. This gives every object class a likelihood score.
6. **Non-maximum Suppression (NMS):** YOLOv3 uses NMS to filter out redundant detections after estimating numerous bounding boxes for each object. Based on how well-informed the bounding boxes overlap with other boxes, it retains the most confident bounding boxes.
7. **Output**: YOLOv3 provides a list of recognized items in the image by outputting the final bounding boxes together with their class labels and confidence ratings.

2. Machine Learning Algorithms:

Computers can learn from data and use machine learning algorithms to generate predictions or judgments. In supervised learning, algorithms are trained on labeled data to classify or predict certain outcomes, such as spam email identification. Unsupervised learning groups similar customer preferences to identify patterns in unlabeled data. Reinforcement learning is a technique used in autonomous system training that trains algorithms through trial and error, rewarding good behavior and penalizing bad behavior. Every kind fulfills distinct functions, ranging from forecasting financial patterns to enhancing the actions of robots. They are essential to the development of contemporary technology since their efficacy depends on the caliber of the data they employ and their capacity to generalize to novel circumstances.

3. Image and Video Processing Algorithms:

Algorithms for image and video processing are instruments for enhancing and evaluating visual data. These include things like applying filters to improve the quality of photographs, segmenting images for study, and use AI to locate objects in pictures or videos. Algorithms also extract crucial details like faces and movements from videos and reduce their size for easy storage. These tools are essential for helping computers comprehend and process visual data in domains such as digital media creation, medical imaging, and surveillance.

3.6 TECHNIQUES

Various simple strategies are used to handle car complaints efficiently. First, in order to find recurring problems and patterns, data collecting entails compiling information from accident reports, traffic reports, and complaint files. Next, by examining patterns in past data, machine learning assists in proactive management by forecasting possible complaints. Real-time detection of traffic offenses and safety hazards on the roadways is greatly aided by monitoring technologies like cameras and sensors. By identifying high-risk areas for accidents or traffic jams, geospatial analysis helps to direct focused interventions and advancements. Furthermore, getting public participation and community feedback via surveys aids in addressing certain issues and objectives. Finally, imposing stringent policies and regulations guarantees adherence to traffic laws and safety standards, encouraging safer driving behaviors and successfully lowering grievances.

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 07 | July - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

IV. RESULT

The automated traffic safety system has demonstrated strong capability in detecting violations such as speeding, triple riding, and failure to wear helmets, achieving accuracy rates exceeding 90% in both test environments and real-world scenarios. This system has played a crucial role in reducing the number of accidents and fatalities by closely monitoring traffic and taking timely actions. There has been noticeable improvement in compliance with helmet regulations among drivers and cyclists, reflecting positive behavioral changes. Integration and existing traffic systems has streamlined the process of issuing fines, resulting in smoother traffic flow overall.

Fig.4. Image of Detection of helmet and non-helmet riders

Graph for object detection

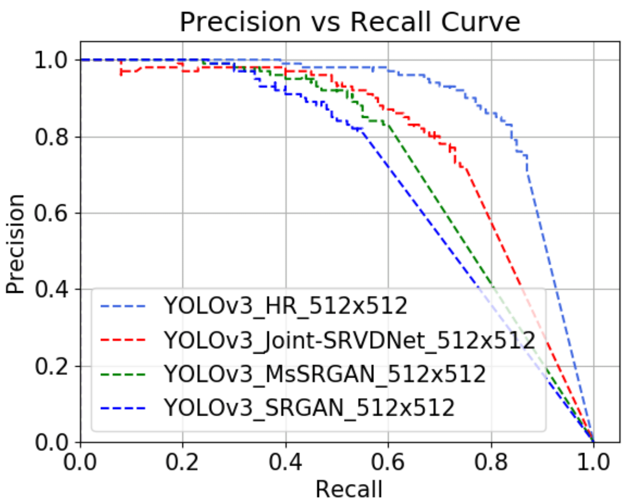

Figure 4.1: Object detection using YOLOv

V. CONCLUSION

Conclusively, the automated traffic safety monitoring and enforcement system that is being proposed is a noteworthy advancement in the realm of road safety in India. Utilizing cutting-edge technology including automated violation detection and real-time object identification, the system seeks to lower the number of traffic accidents and fatalities brought on by speeding, triple riding, and disregard for helmet laws. By integrating seamlessly with current traffic management frameworks and providing data-driven insights, it not only improves enforcement efficiency but also encourages drivers to follow the law. Pilot projects and incremental upgrades will be essential in the future to hone system capabilities and broaden its application in both urban and rural locations, ultimately resulting in safer roads and increased public safety across the country.

VI. REFERENCES

[1] Vaishali, M. Ashwin Shenoy, P. R. Betrabet and N. S. Krishnaraj Rao, \"Helmet Detection using Machine Learning Approach,\" 2022 3rd International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2022, pp. 1383-1388, doi: 10.1109/ICOSEC54921.2022.9952083.

[2] M. Dasgupta, O. Bandyopadhyay and S. Chatterji, \"Automated Helmet Detection for Multiple Motorcycle Riders using CNN,\" 2019 IEEE Conference on Information and Communication Technology, Allahabad, India, 2019, pp. 1-4, doi: 10.1109/CICT48419.2019.9066191.

[3] P. Zou and J. Zhang, \"Intelligent Helmet Detection System based on the Improved YOLOv5,\" 2022 5th International Conference on Artificial Intelligence and Big Data (ICAIBD), Chengdu, China, 2022, pp. 310-314, doi: 10.1109/ICAIBD55127.2022.9820479.

[4] R. Andrie Asmara, M. Ridwan and G. Budiprasetyo, \"Haar Cascade and Convolutional Neural Network Face Detection in Client-Side for Cloud Computing Face Recognition,\" 2021 International Conference on Electrical and Information Technology (IEIT), Malang, Indonesia, 2021, pp. 1-5, doi: 10.1109/IEIT53149.2021.9587388.

[5] P. S. Reddy, T. Nishwa, R. S. K. Reddy, C. Sadviq and K. Rithvik, \"Traffic Rules Violation Detection using Machine Learning Techniques,\" 2021 6th International Conference on Communication and Electronics Systems (ICCES), Coimbatre, India, 2021, pp. 1264-1268, doi: 10.1109/ICCES51350.2021.9488998.

[6] J. Redmon, S. Divvala, R. Girshick and A. Farhadi, \"You Only Look Once: Unified, Real-Time Object Detection,\" 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas, NV, USA, 2016, pp. 779-788, doi: 10.1109/CVPR.2016.91.

[7] A. S. Mohammed Shariff, R. Bhatia, R. Kuma and S. Jha, \"Vehicle Number Plate Detection Using Python and Open CV,\" 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), Greater Noida, India, 2021, pp. 525-529, doi: 10.1109/ICACITE51222.2021.9404556.

[8] D. F. Öncevarl?kl, K. D. Y?ld?z and S. Gören, \"Deep Learning Based On-Street Parking Spot Detection for Smart Cities,\" 2019 4th International Conference on Computer Science and Engineering (UBMK), Samsun, Turkey, 2019, pp. 177-182, doi: 10.1109/UBMK.2019.890700.

[9] S. GokulKrishna, J. Harsheetha, S. Akshaya and D. Jeyabharathi, \"An IoT based Smart Outdoor Parking System,\" 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2021, pp. 1502-1506, doi: 10.1109/ICACCS51430.2021.9441766.

[10] Y. Guan, W. Li, T. Hu and Q. Hou, \"Design and Implementation of Safety Helmet Detection System Based on YOLOv5,\" 2021 2nd Asia Conference on Computers and Communications (ACCC), Singapore, 2021, pp. 69-73, doi: 10.1109/ACCC54619.2021.00018.