2nd International Conference on Frontiers in Engineering Science & Technology
in association with International Journal of Scientific Research in Science,
Engineering and Technology | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
[https://ijsrset.com | doi : https://doi.org/10.32628/IJSRSET]

Road Safety Violation Detection

Moulya S P, Srijith R Nayak, Sainikethan, Suman Deril Desa, Mahesh B L
Department of CSE, Yenepoya Institute of Technology, Karnataka, India

ABSTRACT

Real time road violation detection systems are very important for safety of both riders and pedestrians. Roads are the primary route of transportation in any country, and they are frequently congested due to a lack of traffic management. It may be due to the large population, lack of technology and violation did by the people, among them, traffic rule violation is a major issue. Our work proposes a system that detects individual or different riders taking a trip on motorcycle with no helmets and/or triple ride. In our proposed approach, from the beginning stage, motorcycle riders are recognized with the use of YOLOv5 model which is a consistent type of YOLO model, Yolo V5 is currently one of the generally utilized models for Object Detection.
Keywords: - Faster-RCNN Algorithms, Object Detection algorithms, YOLO Algorithm.

I. INTRODUCTION

The number of accidents occurring each day in India is continuously increasing. Because to the disregard for safety measures such as wearing helmets when triple riding a motorcycle, two-wheelers account for 25percent of road crash deaths. A major reason is when there are more than two drivers on a two-wheeler. As a result, we propose a framework for detecting traffic rule violators who ride motorcycles without wearing a helmet. Using Deep Learning and Image Processing technologies, road CCTV footage is used to detect whether a motorcycle rider is wearing a helmet or not. In contrast to other deep networks such as CNN, fast R-CNN and YOLO, the algorithm employed here is faster R-CNN, which increases the detection rate of motorcycles. The registration number of the violator's vehicle is detected using open-ALPR, and a notification is sent to the local police personals.

We divided the detection into four different categories:

- Motorcycle Detection
- Head Detection,
- Helmet Detection
- Number Plate Detection.

II. BACKGROUND

Because motorcycles are a practical and everyday mode of transportation, Because the majority of motorcyclists do not wear helmets, there has been a dramatic increase in motorcycle accidents, making riding a motorbike an ever- present risk. The majority of deaths in accidents in the last few years have been caused by damage to the head, resulting in trauma to the skull or psyche. As a result, wearing a helmet is mandatory by traffic laws, and failure to do so results in severe penalties. Despite this, a large proportion of motorcycle riders do not follow the rules. The police officer used physical force to try to manage the situation, but it was ineffective in the actual world. The usage of helmets is a significant factor in safety, and the demand for security measures is an indisputable requirement to reduce the number of deaths in road accidents.

According to research, wearing a helmet increased the of surviving an accident by 42 percent. Despite the fact that helmets are necessary for motorcyclists' safety, many of them refuse to use them for reasons such as "it ruins my haircut", "it feels uncomfortable", "excellent helmets are expensive" or "it obstructs my peripheral vision". These are not equivalent to the loss of a life. The current procedure for determining whether or not a motorcyclist is wearing a helmet is for police or other employees to manually inspect each rider. It is impossible for motorcyclists to avoid checkpoints under this arrangement.

As a result, the relevance of automated traffic management systems has grown in recent years. All major urban regions have already deployed massive video reconnaissance systems to keep an eye on a variety of threats. Using an existing system in this way is a cost-effective approach, but many frameworks include a large number of employees whose performance is not relevant over lengthy periods of time. According to recent studies, human surveillance is unsuccessful because as the scope of recorded review expands, so does the number of human errors. We want to increase the efficiency of a traffic stream framework, as well as reduce the cost of human labor and eliminate the causes of accidents. The optimum solution is to create an electronic detection system that can recognize this type of problem without requiring human intervention.

III. RELATED WORKS

A brief analysis has been made based on the research articles we completed: Vishnu published a paper on a technique for automatically detecting motorcyclists driving without helmets in CCTV images. For the video edges, flexible background subtraction was utilized to get the moving item. The motorcycle trips in the moving item were also identified using CNN. They were able to identify 92.87 percent of the violators on average with a low false alarm rate of 0.5 percent, demonstrating the effectiveness of their proposed methodology.

Dharma Raj also exhibited the design of a system that uses image processing and deep convolutional neural networks (CNN) to recognize bikers who do not wear helmets. Their method included motorbike detection, helmet versus no helmet detection, and motorcycle licence plate identification. For the classifier, CNN models were created. When the cyclist wore a hat, it was mistaken for a helmet classifier, which resulted in inaccuracies. This problem could be handled by using headwear to increase the training data.

The system was built with the Deformable Parts Model (DPM), which has a high detection accuracy in the image detection technique, according to Baolin Bai's paper. For object detection, the DPM is both efficient and accurate. The training process used the MPCA algorithm and quick level locating. Despite the fact that the study's technique enhanced detection precision and speed, it could only deal with partial occlusion or damage with the vehicle occlusion problem, and the detection effect was not accurate under the occlusion of vehicle condition or damage severity. Erroneous detections occurred owing to class confusion, such as between car and bus, and false detection in other categories was frequently due to the extremely strong bounding box criterion.

Nagarjuna's article proposed a car accident detection and communication system that would assist in informing families, nearby hospitals, and police of the accident's location. When the car collided, topped, or tilted by more than 30 degrees, the software was able to send messages to the programmed emergency numbers. The fact that the location's coordinates were provided rather than the precise location, which might be determined by an application locating the map's location, was highlighted as a vulnerability in this method.

A deep learning solution called Single Shot Multibox Identification was introduced into the helmet detection problem in Narong's work. Only a single CNN network is used in this method to detect the bounding box region of the motorcycle and rider and categorize whether or not the rider is wearing a helmet. The experiment yielded positive results, indicating that Deep Learning and CNN approaches were effective algorithms for picture detection.

The system employed in Yogameena's research on helmet wear analysis using deep convolutional neural network used the performance metric and meant average precision on CCTV data. The architecture included foreground segmentation using GMM, motorcycle recognition, and detection of motorcycle riders wearing or not wearing helmets using a faster RCNN.

In a Yuanlong publication, they published a study on a traffic accident detection system that combines a self-tuning iterative hard thresholding algorithm for learning sparse Spatio-temporal data and a weighted extreme learning Machine for detection.The disadvantage here was that when the collision occurred at a different depth, false detection occurred.

A similar approach of helmet detection was developed using deep learning in Rohit's paper; they employed the Caffe Model for detection and extraction, which had an accuracy score of about 86, and the Inception V3 model for image classification, which had an accuracy score of 74.

IV. PROPOSED METHODOLOGY

The system is divided into four parts:

- Motorcycle Detection
- Head Detection
- Helmet Detection
- Number Plate Detection

A. Motorcycle Detection

In the world of image processing, recognizing a motorcycle from an image has been a risky situation. The issues encountered were the state of the bike in the photograph, the recognition of folks travelling on a cruiser or an empty vehicle with no rider, the location of the traveler's head, and the differentiating proof of the rider's helmet at the head area. Before detecting the motorcyclist in the frame, several image processing steps were done to the video sequences, and it was discovered that the properties produced using various methods employing the information included in the image itself provide a lower detection rate for motorcycle detection. Deep learning algorithms such as CNN have recently taken on helmet wearing analysis, and they are identical to hand-crafted features. When compared to other deep networks like CNN, fast R-CNN, and YOLO, the faster R-CNN increases the recognition rate of motorcycles. We use CCTV footage films from the target places and partition them into different frames. We then use open-CV source python code to detect objects (based on faster R- CNN), and if the system detects the presence of a motorcycle, it first examines whether it has a rider. The relevant section from the frame is then removed and further examinations are performed.

B. Head Detection

We identified the required frames from the images (utilizing faster R-CNN). If the model detects the motorcycle's proximity, a bounding box is created around it. This zone is then removed from the current frame and sent to the image classifier for later processing (image acquisition, image restoration, linear filtering, and so on). The image classifier separates the test picture from the captured frame and assigns it to one of two objective classes. A pre-trained model could distinguish humans or things such as people, horses, and chairs using a faster R-CNN with VGG-16. It gives the illusion of a human head when the camera is positioned with its angle of depression. The Gabor-Wavelets filter helps to accommodate its sturdiness and stability to changes in scale, direction, and dazzle while recognising highlights that represent facial segments. It consistently recognises the human head in a variety of environments.

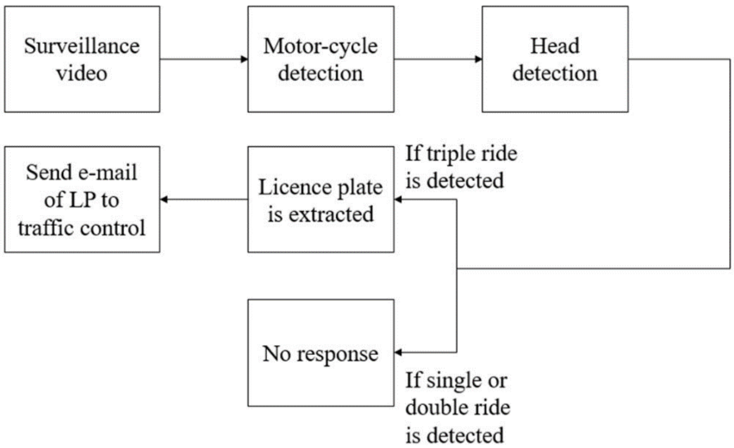

Fig 1. Head and Triple ride detection

C. Helmet Detection

According to related research, existing features and CNNs struggle to handle real-world issues for helmet wear analysis, such as motorcycling helmet identification, thus we adopt a faster R-CNN. We start with a simple model and gradually increase the complexity of the model with RGB colour input channels to obtain a robust and accurate model with helmet or without helmet classification. The identification of persons riding motorcycles or an empty vehicle with no riders, the position of the motorcyclist's head, and the detection of a helmet at the motorcyclist's head position were all investigated. Before it can detect the position of the motorcycle, various image processing procedures must be applied to the video sequence. The detection model in this module recognises the presence of a motorcycle and a person wearing a helmet.

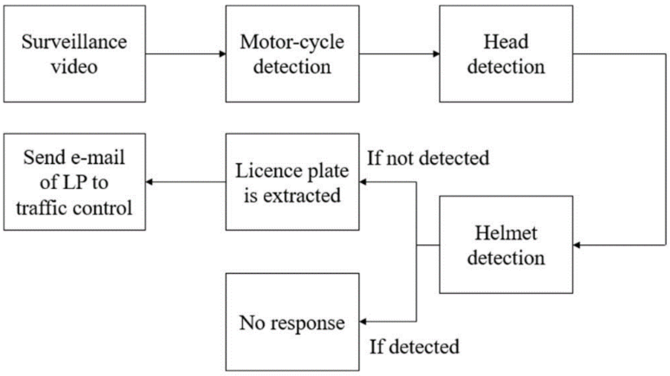

Fig 2. Helmet detection

D. Number Plate Detection

In the same way as motorcycles are detected, motorcyclists with and without helmets are detected in almost the same manner. For character classification of motorcycle licence plates, we've used three distinct CNN models. We assembled the corresponding number plate and prepared the framework with numerous photographs of helmetless riders. That is, the rider wearing a helmet is not considered, but the frame with the motorcyclist without a helmet is included into the database. These images are sent to be processed further. By removing this module, the complete system was evaluated, and the rest of the groupings, such as motorcycle detection and recognition of a motorcyclist wearing or not wearing a helmet, were updated. As a result, in both background and foreground regions, the region associated to the motorcycle, motorcyclist, head, and helmet has been discovered. As a result, it establishes the value of initial foreground segmentation, motorcycle detection, detection of a motorcyclist wearing and not wearing a helmet, and Licence Plate recognition of motorcyclists wearing and not wearing helmets, as well as providing a framework for an automated helmet wear analysis system. The suggested helmet wear analysis framework's main benefit is the research of relevant work, dataset, and experimentation on many sorts of hard settings.

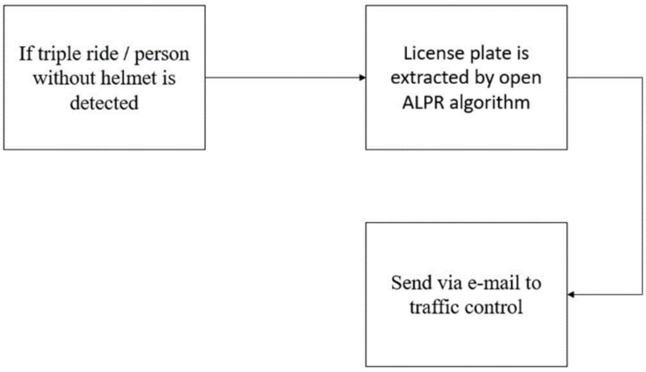

Fig 3. Licence plate detection

E. Interpretation of the result

In the final step, the performance is compared to the preceding two stages and a conclusion is reached. The precision of the investigations will reveal the procedure's exhibition in terms of image categorization and detection. The OpenCV Libraries are utilised in conjunction with the detection system, which includes pre-defined functions and data members for image processing such as background subtraction, morphological operations, feature extraction, and classification.

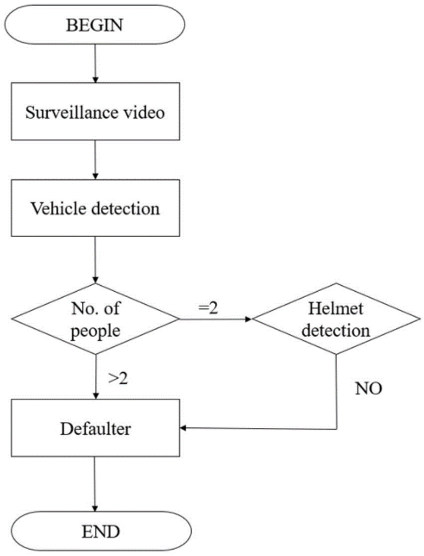

Fig 4: - Block diagram

V. RESULT

Fig 5: - Detection of Bike

Figure 5 shows the outcome of our system's detection of the bike. Blue color boxes are used to highlight motorcycles.

Fig 6: - Bike Rider without helmet detected

Figure 6 illustrates the key aspect of the system, which is the detection of helmetless motorcyclists. The head wearing a helmet is shown in green boxes, whereas the head without a helmet is highlighted in red boxes.

Fig 7: - Cropped Number Plate

After the helmetless riders are identified, their vehicle number plates are cropped (Figure 7) and mailed to the authorities along with the frame.

VI. CONCLUSION

Manual work will be decreased as a result of the implementation of this system, and human limitations will be efficiently addressed. The opportunity for escaping of violators due to negligence has now been limited. More infringers can be detected. We will work toward an automated environment that will minimize the workload on police personnel while also improving the efficiency of the workflow. With the implementation of this new system, rules will be enforced more aggressively, resulting in fewer traffic accidents and fatalities. The system will be automated for the time being. Workflow will be smooth. Road accidents and fatalities will be reduced as a result of enforcement of the rules.

VII. REFERENCES

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

[2]. K. Dahiya, D. Singh and C. K. Mohan, "Automatic detection of bike riders without helmets using surveillance videos in real-time", in Proceeding of International Joint Conference Neural Networks (IJCNN), Vancouver, Canada, 24-2, 2016, pp.3046-3051.

[3]. J. Li et al., "Safety helmet wearing detection based on image processing and machine learning," 2017 Ninth International Conference on Advanced Computational Intelligence (ICACI), Doha, 2017, pp.201-205.

[4]. N. Boonsiri Sumpun, W. Puarungroj and P. Wairocana Phuttha, "Automatic Detector for Bikers with no Helmet using Deep Learning," 22nd International Computer Science and Engineering Conference (ICSEC), Chiang Mai, Thailand, 2018, pp.1-4.

[5]. B. Yogameena, K. Menaka and S. Saravana Perumaal, "Deep learning-based helmet wear analysis of a motorcycle rider for intelligent surveillance system," in IET Intelligent Transport Systems, vol. 13, no. 7, 2019, pp.1190-1198.

[6]. Kavyashree Devadiga, Yash Gujarathi, Pratik Khanapurkar, Shreya Joshi and Shubhankar Deshpande. "Real Time Automatic Helmet Detection of Bike Riders" International Journal for Innovative Research in Science & Technology Volume 4 Issue 11, 2018, pp.146-148.

[7]. R. V. Silva, T. Aires, and V. Rodrigo, " Helmet Detection on Motorcyclists using image descriptors and classifiers", in Proceeding of Graphics, Patterns and Images (SIBGRAPI), Rio de Janeiro, Brazil, 27-30 August 2014, pp.141-148R.

[8]. Redmon J, Farhadi A. YOLOv3: An Incremental Improvement [C]//IEEE Conference on Computer Vision and Pattern Recognition, 2018.

[9]. Redmon, Joseph, and Ali Farhadi. 'YOLO9000: better, faster, stronger.' IEEE conference on computer vision and pattern recognition, 2017, pp.7263- 7271.

[10].Redmon J, Divvala S, Girshick R, et al. You only look once: unified, real time object detection [C]// Computer Vision and Pattern Recognition, 2016, pp.779-786.