**Thesis Progress/Update Report**

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**Tentative Titles:**

Title 1: Traffic Rules Violation Detection using YOLOv5 and OpenCV.

Title 2: Traffic Rules Violation Detection System using YOLOv5 and OpenCV approach.

Title 3: A novel approach to detect Traffic Rules Violation using YOLOv5 and OpenCV.

1. **Proposed Methodology with Graphical Representation:**

Dataset

Trained Model

Violation Detection

Mecahnism

Input Video Stream

violation Detected

Vehicle Images

Transforming video into Frames

License Plate Number

Traffic Rules

Database

**Traffic Rules violations:**

There are many traffic rules and violations. They vary from country to country. Some common and most frequently occurred traffic rules violations are given below which should be inspected for road safety:

* **Violation of traffic signals**: Vehicles which violates the traffic signals.
* **Lane jump violation:** Vehicles which jump to the other lane from it’s preferred lane.
* **Drunken driving:** Driver who drives cars when he is drunk.
* **Seat belt violation:** Drivers and passengers not wearing seat belts properly.
* **Pedestrian crossing violation:** Pedestrians who cross the road by violating rules. Sometimes drivers also violate this rule by driving cars during red signals.
* **Parking violation:** Parking vehicles in non-permitted areas or parking in an unusual manner is termed as parking violation.
* **Texting while driving:** Drivers who drive vehicles while texting on the phone. This rule is also implacable to the pedestrians while crossing roads.
* **Zig Zag driving:** Driving in unusual manner by not following the proper road map.
* **Speed limit violation**: Violation of the speed limit of a particular road by a particular vehicle.
* **Forbidden turns of vehicles:** Sudden turns of vehicles should be detected as a violation.
* **Unfit vehicle driving:** Vehicles which are not physically fit for driving is termed as unfit vehicles.
* **Overtaking vehicles:** Overtaking other vehicles on the roads without proper signals.
* **Helmet Violation:** Two-wheeler drivers and passengers not wearing helmets.
* **Sound violation:** Making improper and unnecessary horn signals by the drivers that cause sound pollution.
* **Driving license violation:** Drivers without carrying driving license papers with them is termed as driving license violation.
* **Non permitted vehicles:** Some vehicles are not permitted in every road. For example, rickshaws are not permitted in highway roads.
* **Driving stolen cars:** Driving cars that are stolen are termed as stolen cars violations.
* **License plate violation:** Vehicles which don’t have proper number plates.

**Traffic Rules Violations of our Model:**

From the mentioned rules, we are working on some of the following traffic rules:

* Frame extractions from video stream
* Detecting non permitted vehicles
* Speed limit violation
* Crosswalk violation
* Helmet Detection
* Lane Jump detection
* Missing car detection

**Classifying Traffic Rules Violations Based on Fatality:**

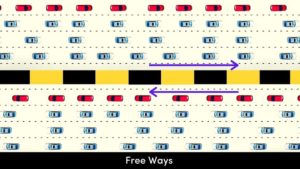
Traffic rules violations can be classified into 2 terms based on severity of harms. Some violations may cause death to the drivers and passengers, we will mention them as “Fatal Violations”. Some violations do not cause risk of life, we will mention them as “Non-fatal Violations”. In both of the cases the violators should be punished according to the law.

* **Fatal Violations:** Traffic rules violations which may cause death are labelled as fatal violations. They are:
* Lane Jump Violation
* Drunken Driving
* Seat belt violation
* Pedestrian crossing violation
* Zig Zag driving
* Speed limit violation
* Forbidden turns of vehicles
* Unfit vehicle driving
* Overtaking other vehicles
* Helmet violation
* **Non-fatal Violations:** Traffic rules violations which do not cause death are labelled as non-fatal violations. They are:
* Stolen car violation
* Non permitter vehicles
* Driving license violation
* License plate violation
* Unfit vehicle driving
* Sound violation of vehicle horns
* Traffic signal violation
* Parking car violation

**Traffic Rules in Different Types of Roads:**

Traffic rules are not same for every kind of roads. Because particular road have particular permitted vehicles and road width also make an impact on traffic rules.

* **Freeways:** Freeways are large roads which are used for heavy traffics. Speed limit of this kinds of roads are comparatively high and lightweight vehicles like rickshaws, bi-cycles, motorbikes etc. are not permitted on this road. These are generally designed in four lanes, two lanes in each direction. Traffic movement on freeways is continuous and unhindered because there are no railway or road intersections and no signals.



**Figure 1: Freeways**

From the above image we can see that, there is no obstruction and free flow of traffic in each direction. Parking and Walking are strictly prohibited on freeways and they don’t have footpaths on either side of roads.

* **Highways:** Highways connect villages to cities or cities to cities or state to state or the roads connect the state capital to the national capital are called highways. Highways are the roads run through the length and breadth of the country. They are generally laid in two lanes. Highways are further classified into National Highways, State Highways, Urban Highways and Rural Highways.



**Figure 2: Highways**

* **Expressways:** Expressways are one of the superior types of access-controlled roadways where the entry and exit of the expressway are fully controlled by ramps. As the name itself “express” echoing that these are meant for a free flow of very speed traffic. Expressways are designed to travel quickly with great comfort and safety by avoiding sharp curves, busy traffic intersections, railway junctions. Vehicles with high acceleration are only permitted in expressways. Heavy load vehicles, cargo vehicles, pedestrians are not allowed. Parking, loading and unloading are strictly prohibited on Expressways.



**Figure 3: Expressways**

* **Local Streets:** Local streets don’t carry a large volume of traffic like arterials. The speed limit is restricted to 30km/hr in a local street. Local streets allow you to properties around it. In simple the road which you to take to reach the nearest vegetable market is the local street.

Pedestrians can cross the road at any point in local streets. Unrestricted parking, loading and unloading of vehicles are allowed in local streets. They usually don’t have any divider with boulders but divided with 1m dotted white lines or straight white line.



**Figure 4: Local Streets**

**C. List of related Good Quality Articles in Solving the Same or Similar Problem with different methods.**

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| --- | --- | --- | --- | --- | --- |
| **Sl.** | **Ref. and Year [Inverse]** | **Article Title** | **Method Name** | **Name of the Journal** | **Volume, Issue and Page** |
| 1 | Tonge et al. 2020[1] | Traffic Rules Violation Detection using  Deep Learning |  | IEEE |  |
| 2 | Franklin et al.  2020[2] | Traffic Signal Violation Detection using Artificial  Intelligence and Deep Learning |  | IEEE |  |
| 3 | Zhaoyang et al. 2020[3] | A motion based object detection method |  | IEEE |  |
| 4 | Hou et al. 2020[4] | Video road vehicle detection and tracking based on OpenCV |  | IEEE |  |
| 5 | Kulkarni et al.  2020[5] | Real Time Vehicle Detection, Tracking and Counting Using Raspberry-Pi |  | IEEE |  |
| 6 | Yanyong Guo et al. 2016[6] | Automated analysis of pedestrian walking behaviour at a signalised intersection in China |  | IET |  |
| 7 | Zehang Sun et al. 2006[7] | On-Road Vehicle Detection: A Review |  | IEEE |  |
| 8 | Jitendra Sharma et al. 2014[8] | A Hybrid Technique for License Plate Recognition Based on Feature Selection of Wavelet Transform and Artificial Neural Network |  | IEEE |  |
| 9 | Koneti Sandeep et al. 2017 [9] | Novel drunken driving detection and prevention models using Internet of things |  | IEEE |  |
| 10 | Suparna Sahabiswas et al. 2016 [10] | Drunken driving detection and prevention models using Internet of things |  | IEEE |  |

**D. List and Notes of Articles Closely Related to Our Method**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.** | **Ref. and Year** | **Article Title** | **Method Name** | **Name of the Journal** | **Volume, Issue and Page** |
| R1 | Tonge et al. 2020 | Traffic Rules Violation Detection using  Deep Learning |  | IEEE |  |
| R2 | Franklin et al.  2020 | Traffic Signal Violation Detection using Artificial  Intelligence and Deep Learning |  | IEEE |  |
| R3 | Yanyong Guo et al. 2016 | Automated analysis of pedestrian walking behaviour at a signalised intersection in China |  | IET |  |
| R4 | Jitendra Sharma et al. 2014 | A Hybrid Technique for License Plate Recognition Based on Feature Selection of Wavelet Transform and Artificial Neural Network |  | IEEE |  |

**Identification of difference or significance of our method comparing with individual ones:**

Comparison and Construct with respect to R1:

In this paper, the two types of violation detection method is done. And the process of the whole method is to

\* Detect vehicle

\* Helmet classification

\* Crosswalk violation

\* License plate recognition

The differences between our model with this paper's approach are that :

1. On the paper, they used the YOLO model with pretrained weights. But where we trained our model with YOLOv5 architecture which is an updated version of YOLO, with Bangladeshi vehicle images. For this reason, the recognition of vehicles is much better than the pre-trained weights.
2. For license plate recognition in this paper, the model used is based on a YOLO-based trained model to detect license plates and then use OCR to detect letters from the license plate image. But we are using an OpenCV approach for detecting license plates by finding contours in the images. Our approach could be better than the trained model approach. We are currently working on a training model with license plate images to find out.
3. This paper only proposed detecting two types of violations. Our proposed model will work on detecting 5 types of traffic rule violations.
4. We are planning to work on both helmet classification and crosswalk violation with a different approach using OpenCV.
5. Dataset used for testing is around 1000 images. We are planned to perform testing of more than 1000 images to find out a better evaluation of our method.

Comparison and Construct with respect to R2:

In this paper, a method of speed violation detection and lane jump detection is shown. The model used in this paper is YOLOv3.

We are planned to implement the same features using the OpenCV approach by using a motion detection technique. Because of this approach, our model will be able to detect violation of the speed limit and lane jump in various vehicle classes.

Comparison and construct with respect to R3:

A method microscopic-level analysis such as Gait parameters analysis is shown in this paper which allows the estimation of walking mechanism parameters such as step frequency and length for different pedestrian groups. By analysing the walking speed and step frequency the system can predict if the pedestrian is violation the crosswalk rules.

We have planned to use this methodolgy to detect crosswalk violation with the aid of OpenCV.

Comparison and construct with respect to R4:

In this paper, a method was shown to detect licence plate number of vehicles using RBNN and Wavelet Transform. The main idea of this paper is to binarize the image with low frequency using Wavelet transform and exctract the character and recognize the license plate number with the help of RBNN.

In our work, the license plate number detection is yet to be done. We are working on it and planned to use some OpenCV approach with the idea of the referenced paper.

**References:**

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[3] C. Zhaoyang, G. Haolin, and W. Kun, “A motion based object detection method,” in *Proceedings - 2020 2nd International Conference on Information Technology and Computer Application, ITCA 2020*, Dec. 2020, pp. 280–283. doi: 10.1109/ITCA52113.2020.00067.

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[7] Z. Sun, G. Bebis, and R. Miller, “On-Road Vehicle Detection: A Review.”

[8] J. Sharma AmitMishra Khushboo Saxena, S. Kumar Asst Professor, M. Tech Scholar, and A. Professor, “A Hybrid Technique for License Plate Recognition Based on Feature Selection of Wavelet Transform and Artificial Neural Network.”

[9] K. Sandeep, P. Ravikumar, and S. Ranjith, “Novel Drunken Driving Detection and Prevention Models Using Internet of Things,” in *Proceedings - 2017 International Conference on Recent Trends in Electrical, Electronics and Computing Technologies, ICRTEECT 2017*, Dec. 2017, vol. 2017-December, pp. 145–149. doi: 10.1109/ICRTEECT.2017.38.

[10] S. Chakrabarti, H. N. Saha, University of British Columbia, Institute of Electrical and Electronics Engineers. Vancouver Section, and Institute of Electrical and Electronics Engineers, *IEEE IEMCON - 2016 : the 7th IEEE Annual Information Technology, Electronics & Mobile Communication Conference : 13-15 October 2016, University of British Columbia, Vancouver, Canada*.