REAL TIME HELMET, SEATBELT & TRIPLE RIDING DETECTION

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Abstract: *The main aim of the work is to reduce the number of accidents and deaths by road transport, Real Time Helmet, Seatbelt & Triple Riding Detection by using image processing. These might be implemented in the traffic cameras in the society, by using this image processing the video cross checks with the image if the given image does not match with the video it will note down the vehicle number and generate fines. By this method it generates fear in environment and the everyone will follow the rules. The police or traffic men cannot be anywhere to verify the proper following of rules. By using this project, we can find them easily. Another use of this project is it would be, it will note down all the numbers of a vehicle and checks the vehicle is registered or not if it is not registered it note down the numbers. By that we would catch them easily, and another use is it would to see the past and present position of the vehicle.*
Keywords : YOLO, DIP

I. INTRODUCTION

(a)Helmet Detection:

All over the world around 1.35 million lives are lost each year, 50 million people are getting injured due to road accidents, according to a report titled "The Global status report on road safety 2018" released by world health organization. It is very hard to imagine that this burden is unevenly borne by motorcyclists, cyclists and pedestrians. This report noted that a comprehensive action plan has to be set up in order to save lives. Worrying fact is that India ranks number one as far as road crash deaths are Considered. Rapid urbanization, avoiding helmets, seat belts and other safety measures while driving are some of the reasons behind this trend according to analysis done by experts.

In 2015 India signed Brasilia Declaration on Road Safety, where India committed to reduce road crash deaths to 50 percent by 2020. Policy makers first have to acknowledge the problems that persist in India before halving road crash deaths. When a two-wheeler meets with an accident, due of sudden deceleration, the rider is thrown away from the vehicle. If head strikes any object, motion of the head becomes zero, but with its own mass brain continues to be in motion until the object hits inner part of the skull. Sometimes this type of head injury may be fatal in nature. In such times helmet acts as life savior. Helmet reduces the chances of skull getting decelerated, hence sets the motion of the head to almost zero. Cushion inside the helmet absorbs the impact of collision and as time passes head comes to a halt. It also spreads the impact to a larger area, thus safeguarding the head from severe injuries.

More importantly it acts as a mechanical barrier between head and object to which the rider came into contact. Injuries can be minimized if a good quality full helmet is used. Traffic rules are there to bring a sense of discipline, so that the risk of deaths and injuries can be minimized significantly. However strict adherence to these laws is absent in reality. Hence efficient and feasible techniques have to be created to overcome these problems. Manual surveillance of traffic using CCTV is an existing methodology. But here so many iterations have to be performed to attain the objective and it demands a lot of human resource. Therefore, cites with millions of population having so many vehicles running on the roads cannot afford this inadequate manual method of helmet detection. So here we propose a methodology for full helmet detection and license plate extraction using YOLOv2, YOLOv3 and OCR

Fig 1. Frames collected at regular intervals

(b) Triple Riding:

Road safety is the most important aspect of this automobile driven technological world. Considering the number of people taking road transport as the means to reach their destination, the number of people reaching the heavens instead of their safe home, increasing day-to-day. As per Indian government data, in 2017 alone, 1, 47,913 people were killed in road accidents across India. One lakh forty-seven thousand nine hundred and thirteen dead bodies on Indian roads in just one year. This figure is 37.54% more than the total number of people killed in floods and heavy rains in the last 65 years in India. In the 17 years between 2001 and 2017, (the latest year for which official data on road accidents are available), a total of 20.42 lakh people lost their lives in road accidents and 82.30 lakh were injured.

In total, India witnessed 79.10 lakh road accidents at an average of 9 crashes every 10 min. On account of the recent stats, the irresponsible driving of the two-wheelers or the heavy speeding of the four-wheelers is the major reason for the occurring accidents. These irresponsible drivers are making it hard for the drivers those follow the traffic rules. Just as the saying goes, the has no part to play in "Queue", the prior rules do not affect the irresponsible drivers. The current increase in the fine/challan system might control these irresponsible drivers to an extent, but this is not a permanent solution that we can rely on. Monitoring the roads continuously for these kinds of irresponsible drivers is human effort consuming.

The currently existing CCTV surveillance system can come to aid to some extent where the continuous monitoring of the system again makes it difficult. Hence, this CCTV surveillance system needs automation thereby, reduces the human effort in monitoring the traffic rule violators. This paper aims to provide the automation to the CCTV surveillance system, which will help in finding the riders, triple riding the vehicles.

Fig 2. Test images for the triple riding

(c) Seat Belt Fastness Detection:

In 2014, according to the National Highway Traffic Safety Administration (NHTSA), there were 9,385 fatalities on US roads due to unbuckled passenger vehicle occupants. Between 2010 and 2014, 63,000 lives were saved in vehicle accidents, because they were using a seat belt restraint device. Drivers or passengers in a vehicle could become projectiles during an accident. If the belt is unbuckled the passengers can very easily be ejected resulting in death and statistics showed that using a belt could give a surviving probability 44% more [1]. Automatically detecting and tracking driver behavior inside the vehicle cabin is important in safety applications [2], [3] such as detecting head rotation angles, eye status, driver activities (eating, drinking, using the phone) and seat belt state as well more important since it could rescue from death in crucial accidents. Most existing algorithms depend on edge detection that are not stable in variation environments. They are not accurate because of the huge possibility to find edges with a slope similar to the belt in the driver jacket. Especially inside the car's cabin as well they are weak against rotation and noise.

We introduce a new model based on the YOLO neural network to detect the seat belt fastness and recognize its status. We classify belt fastness between three cases: the belt is not fastened, the belt is fastened correctly, and the belt is fastened behind the back. We have collected the videos from different drivers that drive the vehicle with a fastened belt, without a fastened belt, and with a belt fastened behind the human body. We train the neural network model based on these videos and test it for different drivers. Then we identify the situations when the model works incorrectly to study it again. So, after a few interactive steps, we can conclude that the model works fine against driver rotation and noise related to the lighting conditions.

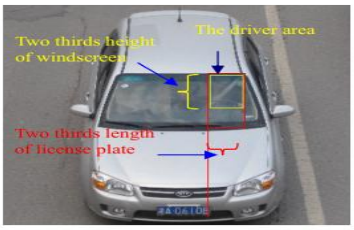

Fig 3. The driver area position in vehicle

II METHODOLOGY

In this section we explain different processing steps. At initial phase, frames are collected at regular intervals from video file as shown in Fig. 1(a) and Fig. 1(b). The collected frames are stored in a folder. They are named such that they include the frame number in their name, for example frame_7_50, frame_7_100 etc... Where indicates that it is 7th video file input and 50, 100 etc.… indicates the frame number. From the figures, it is clear that many frames are redundant. So, based on movement of vehicle movement with respect to camera, last frame or last second frame is chosen for further processing. The entire work can be divided into following 5 phases for two cases:

Case 1: When the motorcycle/moped rider is wearing helmet
Case 2: When the motorcycle/moped rider is not wearing helmet Frame Collection Frame Collection

With the help of functions given by Image AI library, only the detected objects are extracted as shown in Fig. 3 (a) and Fig. 3 (b) and stored as separate images and named with class name and image number in order. For example, it will be saved as motorcycle-1, motorcycle-2, etc.… if extracted object is motorcycle or person-1, person-2, etc.… if extracted image is of person. The details of these extracted images which is stored in a dictionary which can be later used for further processing.

In the last 10 years, researchers are trying to explore new ways to address the problems related to the traffic i.e. Bartlomiej Placzek et al. proposed a vision-based algorithm to detect the vehicle in the detection zones is important for the traffic control system [8]. Having this system to identify the high traffic prone zones to use more human effort to control the traffic and reducing the traffic rule violators is the objective of the author. The author used the linguistic variables and fuzzy sets to classify the input through several occurrences of a frame that background or vehicle in greyscale. The results verified through extensive testing in various conditions as well. Hu et al. used Histogram of oriented gradient features to detect the vehicles in recorded videos and classify the vehicles. Here in this paper, the concept of the people traveling on the vehicle has not been addressed [5]. In the case of detection of the vehicles moving on that particular junction, this algorithm can be implemented in the real world. Maharsh Desai et al proposed helmet detection system, alcohol detection system, fall out detection system to reduce the number of accidents. The authors used subtraction; Hough transform descriptors to detect the helmet. As it is always preferable to reduce the causalities before the detection of fall out, the triple riding which can lead to the fall out has not been addressed [2]. Kunal Dahiya et al. also proposed a method to detect the bike riders from video using subtraction, object segmentation which determines whether the bike rider is using the helmet or not [1]. This system acquired better accuracy of 93.80% with a processing time of 11.58 ms per frame in a surveillance video

III PROPOSED METHOD

(a)Helmet Detection:

Once the person-motorcycle pair is obtained, the person images are given as input to helmet detection model. While testing the helmet detection model, some false detection were observed. So, the person image was cropped to get only top one-fourth portion of image, as shown in Fig. 4. This ensures that false detection cases are eliminated as well as avoid cases leading to wrong results when the rider is holding helmet in hand while riding or keeping it on motorcycle while riding instead of wearing. After applying cropped image to helmet detection model, output is as shown in Fig. 5. The bounding box around helmet along with the detection probability is displayed as shown in Fig. 5. As the rider wearing helmet in Case 1, no further processing is necessary. Since in Case 2, rider is not wearing helmet, no bounding box is created.

(b) Seat Belt Fastness Detection:

In this section, we propose a new neural network model based on YOLO for seat belt fastness detection. More specifically, the main objectives are to differentiate between the three cases: (1) seat belt placed correctly, (2) seat belt is fastened behind the back, and (3) seat belt is not placed at all.The driver seat belt detection is similar to any other driver's activity detection (eating, using the phone, and etc.). However, this problem is more complex since the type of features we can obtain from the belt which has a wide similarity to multiple other objects in the vehicle cabin. Most of the belt detection models are trained based on local data, and it is hard to find such as these images for drivers inside the car cabin hence more similar projects are for detecting the seat belt from camera surveillance images. So, we gather data locally from multiple drivers and preprocess it to obtain quality training

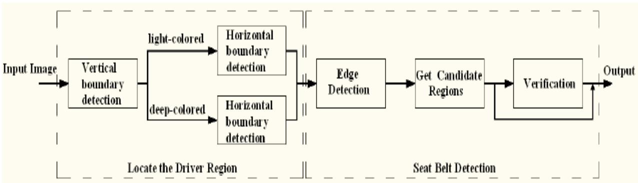

Fig 4. Seat belt detection

The driving environment has many illumination varieties. We propose to make the belt more visual. We use the IR camera that provides possibilities to get high quality pictures at night time. Since the camera gives a visual appearance of the driver and the belt, but as well it could receive the same waves length to two different similar colors. Then in some lighting conditions, it is really hard to differentiate between the belt and background. We implement image transformation from colored to gray images. Then histogram equalization is applied to decrease the contrast between the daylight and the cabin backgrounds. Followed by a transformation from grayscale to Lab coordinates where L holds for lightness and a,b for the compressed values of the pixels. An adaptive algorithm for contrast enhancement is applied.

(c) Triple Riding:

The system is divided into 2 main subsystems setting up the environment, training, testing the model and getting the accurate coordinates of the vehicle comes along with the system, and to pull the data GSM module or the public network. The Proposed system of triple riding is illustrated in Fig. The imposing challans or fines with an automated push of the data to the respective user account come as an extension to the system. 1. Traffic Rule Violation Recognition System 2. Vehicle Tracking System

The system mainly uses the deconvolutional approach of the deep learning along with the deep learning framework Darknet and the object detection algorithm YOLOv3 performs the various functionalities like detection, recognition, and Identification, followed by classification. The subsystem having the support of the image, video and live feed as the input, enables the system to process all kinds of data. Having the image and video input assessment as an extension, the live feed of the camera modules deployed at the junctions processes every single frame. Every single frame is subjected to the detection of the various objects.

In our prototype model, the various objects that were subjected to the process of the training are the bike and the person. The two objects bike, and person are the most important aspects of the focus. This system mainly consists of a GPS module and a NodeMCU. The GPS module gives us the latitude, longitude and the velocity of the vehicle. This system makes use of the public network to connect with the NodeMCU module to extract the latitude, longitude, and velocity and send this data to the cloud for effective visualization of data. The platform used at the time is Firebase.

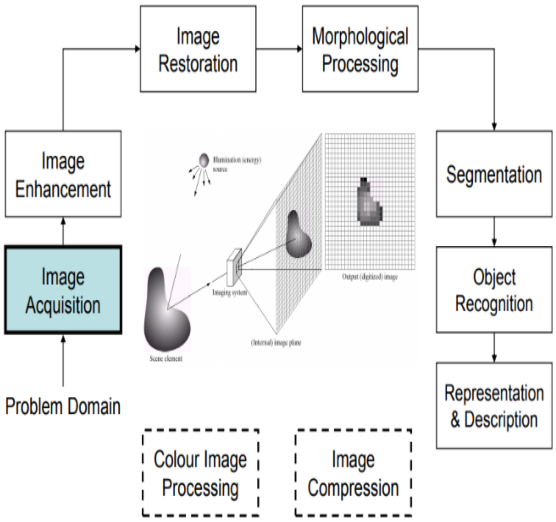

Fig 5. Proposed system for segmentation Process

IV SIMULATION RESULTS

The results of the proposed system will be discussed here. The system is tested on images that have triple riding as well as images that do not have triple riding to check how accurate our system is. The results are displayed in the table. As depicted from Fig. the system. Detects triple riders and puts a bounding box on them and labels them as triple riders. The accuracy of our model is 91.7% with an F1 score of 0.947 and also the precision value of our system is 0.9. The system without IOU layer resulted in lower accuracy of 90.4%. Because of the GPS module and the Node-MCU provides us with the exact coordinates of the vehicle and sent to the real-time database of Firebase for storing and constant update of data. Table lists various models used in different papers and their accuracies.

Fig :6. The driver area position in vehicle

Most of the systems that are already proposed by other people concentrate on traffic rules like wearing helmets and breaking the speed limit. But our system has put together an algorithm that can distinguish triple riding bikers which is another violation of a traffic rule. Implementation of this kind of system will increase general awareness and hence reduce accidents.

Fig:7. The Violator Image for triple riding

This system mainly consists of a GPS module and a NodeMCU. The GPS module gives us the latitude, longitude and the velocity of the vehicle. This system makes use of the public network to connect with the NodeMCU module to extract the latitude, longitude, and velocity and send this data to the cloud for effective visualization of data. The platform used at the time is Firebase.

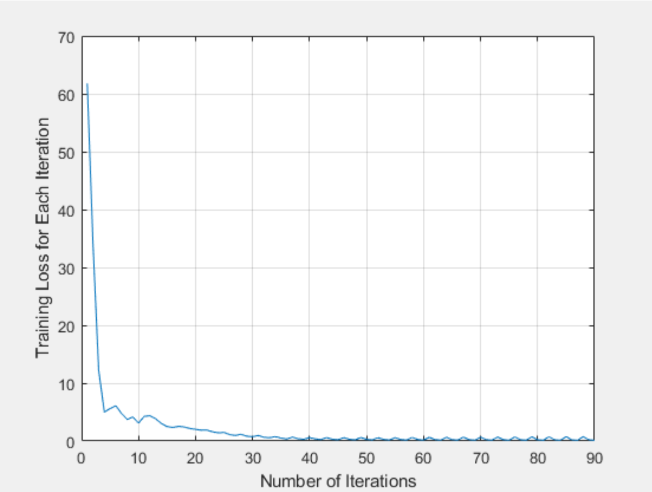

Fig 8. The driver area position in vehicle

Fig:9. The Violator Image for without helmet

CONCLUSION

We constructed the Yolov2 triple riding/without helmet detector model and evaluated our method on images available on google. We got the ground truth labels from the collected dataset. A Non-Helmet Rider Detection system is developed where a video file is taken as input. If the motorcycle rider in the video footage is not wearing helmet while riding the motorcycle, then the license plate number of that motorcycle is extracted and displayed.

Object detection principle with YOLO architecture is used for motorcycle, person, helmet and license plate detection. With the help of these labels and predefined network Yolov2 we have detected the rule violator appearance for the given input image and send to the Gmail account. Comparing with the existing approaches, our method gives better results.

FUTURE WORK

We can extend this work to detect over speed, lane crossing, signal violators etc by connecting to hardware components.

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