smart vehicle security and traffic rules violation detection system

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***Abstract*- There are frequent traffic law violations in India, which happens to be one of the most populated countries in the world. Traffic is disrupted due to these traffic violations. In addition, these violations of traffic rule can cause a very serious threat to the safety of road travelers. In India, two wheelers are being used in maximum numbers because of their comparatively low cost and ease to use. But People often violate these traffic rules by, say for example, not wearing a helmet while riding a motorbike. As a result, a very large number of accidents occur in India which often results in human casualty and loss of property. We propose a new system titled" SMART VEHICLE SEUCRITY AND TRAFFIC RULES VIOLATION DETECTION SYSTEM". This system detects motorcycle riders violating traffic rules with the help of image processing and real time surveillance. Initially, our system identifies exactly the motorcycle riders among the various vehicles passing on the road, by means of techniques such as background subtraction and object segmentation. It makes it easy to separate out and identify bike riders quickly. We, in our system use object classifier algorithm which differentiate between those riders following the traffic rules and those violating the same. This classifier will play an important role to identify traffic rule violation incidences such as riders not wearing a helmet riders engaged in triple seat riding. By detecting these traffic rule violations, we intend to make roads more safe for all users of it. This proposed system has many advantages like it will cut down the workload of already heavily loaded traffic control authorities. The system captures evidence of traffic rule violations through real time surveillance videos which can be used for imposing fines on traffic rule violators. This system also promotes a culture of following traffic rules. It also contributes towards reduction in accidents which can save lives and property.**

***Index Terms*- Traffic Law Violation, Vehicle Security, Image Processing, Object Classifier, Real Time Surveillance.**

I. INTRODUCTION

An estimated 1.35 million people worldwide lose their lives in road accidents every year as per a report titled "The Global status Revised manuscript Received on December 05,2019 report on road safety 2018". I addition to this, a whopping 50 million people go through injuries as a severe consequence of these road accidents. These horrifying stats indicate the need of immediate attention and action to reduce these casualties and injuries taking place on a global scale. The main conclusion of the above mentioned report is the considerable number of motorcyclists, cyclists and pedestrians are more prone to road accidents worldwide and these three categories of road users are at high risk of fatality or serious injury. The seriousness of this issue points in the direction of systematic action plan to save lives on the road.

Bicycles and two wheelers are the mostly used modes of transportation in most of the countries. Use of bicycle or a two wheeler creates high risk for its user because of no protection is provided within the vehicle itself so as to reduce the risk of injury or casualty in case if an accident. When a bike rider or a bicycle rider meets with an accident, usually head injuries occur which result in death of the rider.

Here comes the roll of a helmet which definitely can save the life of a rider if he/she is wearing it in case of an accident. The impact of collision in case of an accident is absorbed by the cushioning provide inside the helmet and it brings the head to halt gradually and not abruptly.

In 2015 India signed Brasilia declaration on Road safety. I this declaration it was decided to take efforts in order to reduce road accidents by 50 percent by 2020 .To ride a bike without wearing a helmet is made a punishable offence by Government of India . But these manual methods of reducing road accidents have proved ineffective because these methods require frequent human monitoring.

Hence automation of this process is very much needed because it is robust in nature in addition to being reliable. In recent time research has been made by using technologies like Convolutional neural networks (CNN), Region based

CNN (R-CNN) Local binary patterns (LBP) etc. All these methods try to increase efficiency, accuracy and speed of object detection and classification for making use of helmet compulsory to bike riders in order to increase road safety.

II. SYSTEM OVERVIEW

In proposed work, a unique system is being developed which traffic violations in the form of riders not wearing helmets are detected and at the same time image of the licensed number plate of the concerned bike ridden by the rider is also captured. This detection process is conducted multiple times so as to make sure the high level of accuracy of the system.

At the beginning, the system makes use of YOLO v3 (You only look once version 3) to identify two primary objects a bike rider and the motorcycle. YOLO v3 is an advanced algorithm having very high speed and precision. Once the objects are identified by the system, it goes to the succeeding stage.

In the second stage, the system makes use of YOLOv3 algorithm to detect riders wearing helmets specifically. This is the important step which will detect riders not wearing helmets.

In the final stage system uses web API to detect and capture license number plates from vehicles engaged in traffic rule violation. The license number plates are extracted through web automation techniques.

Then the system produces a panoptic (all inclusive) database which contains valuable information for analysis by law enforcing authorities. This database contains records of non-helmet riders, their vehicle details and license plate numbers. With this automation, this system increases traffic law enforcement capabilities, which makes road safety a priority ensuring a more safe traffic environment than earlier.py without the underlines.

III. PROBLEM STATEMENT

Road safety is utmost important for pedestrians as well as people travelling with a vehicle. Road accidents are increasing day by day with increasing number of people using road transport. Road accidents often end in either injury or death which is very worrying. Rash driving, over speeding of two wheelers as well as four wheelers are one of the main causes of road accidents. Imposing penalties, fines are some of the majors to curb At present traffic rule violations are monitored through CCTV but this monitoring has not proved to be effective enough to reduce the number of accidents

IV. PROPOSED SYSTEM MODEL

The proposed system comprises of two main components, hardware and software. The hardware consists of high resolution video cameras and a GPU image processor. The high resolution video camera captures video streaming data from the site and the real time processing of data is done by the GPU image processor.

As far as software is concerned, the python library Tkinter will be used for designing front end user interface and YOLOv3 algorithm along with plate recognizer application programming interface will be used at the back end. Both video and images are processed by the software. These videos and images will be utilized for detecting helmets, extracting number plates and identifying triple seat bike riders. The results then are displayed on user interface.

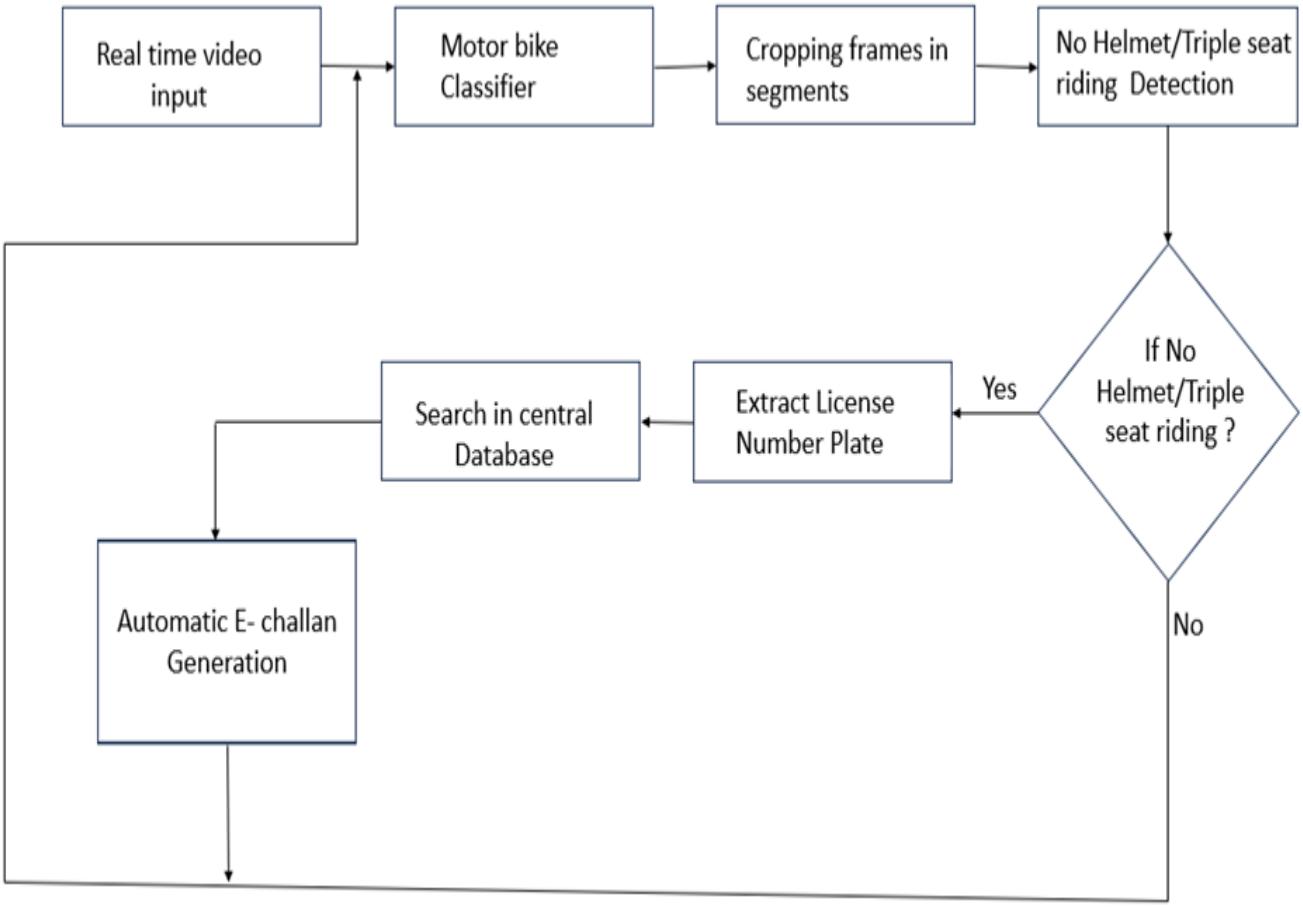


fig. 1 Block diagram

V. HELMET DETECTION

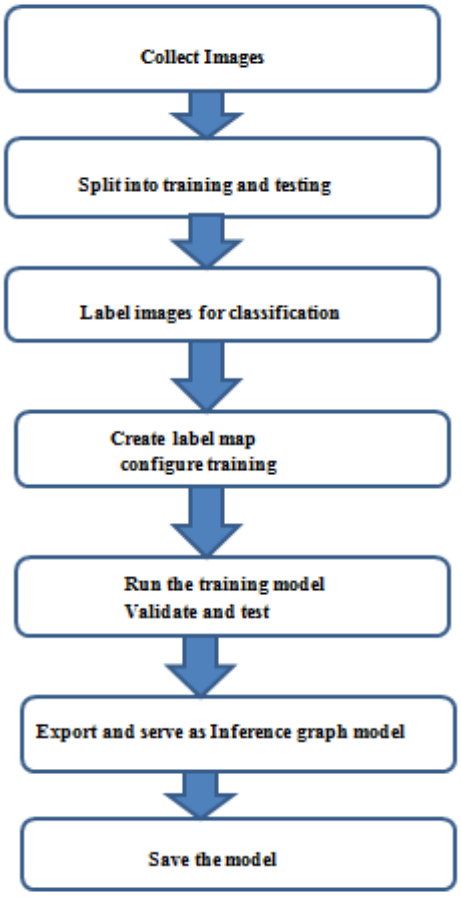
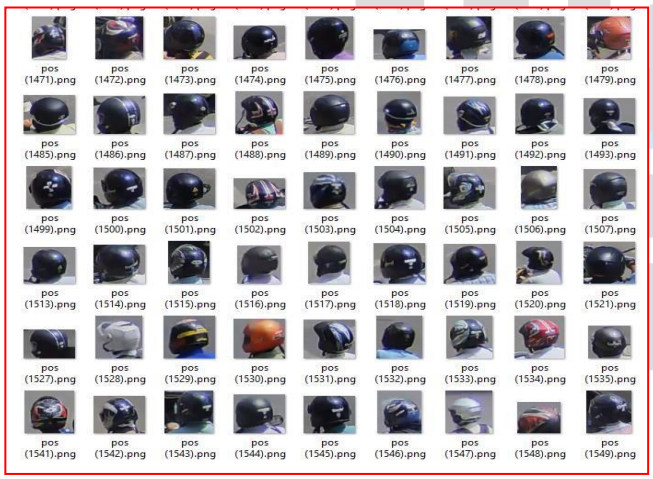


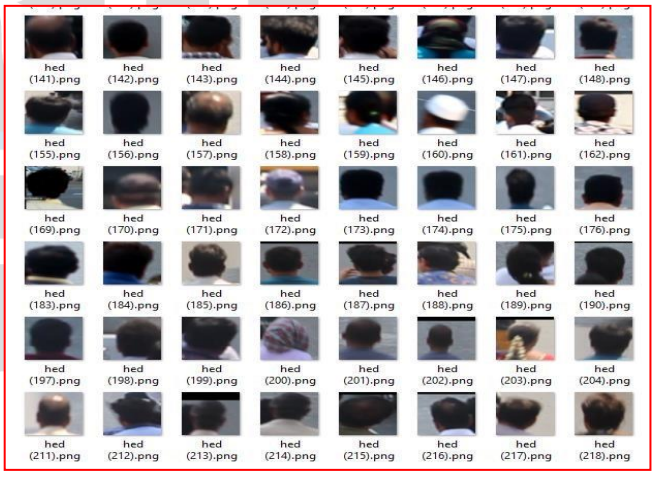
Fig.2 Flowchart for helmet model.

A. Procedure for training a YOLO v3 Helmet model

Collecting images-A large number or images of bike riders wearing helmets, bike riders not wearing helmets and bike license number plates are required. In the proposed system more than 1200 images are used.



Images of bike riders wearing helmets



Images of bike riders not wearing

Label Images:

Use Lablemg tool to interpret all images. The helmet class is established using Lablemg tool. A .xml file is generated for each image dividing them as per the specified classes. A train –test split is then done with the help of data set labels available in required format. We are proposing to create a test set of 10% of dataset's images. The obtained dataset processed by YOLOv3 algorithm. After creating train and test sets some adjustments must be made to train

the YOLO model on the datasheet.

Training:

We can start the training process once the prepared dataset is available. First the dark net repository is built using 'make' command. Then compilation is done by using specific options like GPU, CUDNN and OPENCV support. After compilation, darknet will be generated for execution. After obtaining the trained model, parameters like learning rate, momentum, weight decay can be modified as per the need. For this we have to edit the respective line.

License plate extraction:

Plate recognizers API is used for obtain details of license number plate. This API gathers cropped vehicle images, which contain the recognized license plates. The API the carries out Optical character recognition (OCR) to extract the alphanumeric characters from the number plates. The API uses deep learning models for recognition of number plates. At last the API provides the extracted license plate information, specifically marking alphanumeric characters along with additional data if available.

Fig.4 Number plate detection.

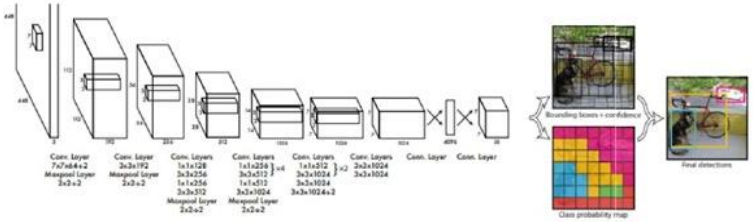
Triple seat riding detection:

Firstly, the system analyses real time camera inputs to identify objects like motorcycles and persons. If triple seat rider is detected the Intersection over Union (IoU) function is used to establish connection between detected person and motorcycle. It will then mark rectangular boxes around the detected triple seat riders.

Fig.5 Triple seat detection.

Dataset:

We have gathered a diversified dataset which includes images of urban landscapes, highways, rural areas etc. This dataset consists of self-explanatory images, providing bounding boxes for helmets, license number plates and instances of triple seating. It sis made sure while designing this system that the dataset covers a variety of lighting conditions, weather conditions and changes in object appearances. This dataset consists of 600 training images and 200 testing images. There are four classes of images: Rider, license plate, Helmet and without helmet.



As compared to traditional object detection systems, YOLOv5 does the object detection very fast. It divides the image into a grid and forecasts bounding boxes and class probabilities for each grid cell. This makes it possible for YOLOv5 to get real time object detection with very high accuracy. YOLOv5 consists of a foundational network for feature extraction from input image. It also consists of multiple detection heads the anticipate bounding boxes and class probabilities. The foundational network is a convolutional neural network like Darknet or CSP darknet used to capture meaningful image features. YOLOv5 has an efficient architecture making it applicable for a wide range of platforms covering CPUs and GPUs. It can process on various image sizes Whether small, medium or large.

VI. SYSTEM DESIGN

1.1 Procedure

Install Tensor Flow-GPU and all required libraries

i. Set up Object Detection directory structure and Google collab Environment
ii. Gather and label pictures
iii. Generate training data
iv. Create label map and configure training
v. Train object detector
vi. Test it out.
vii. Extract license plate number
viii. Generate E-challan

VII. SYSTEM REQUIREMENTS

Main software and libraries used

1. There is no need of set up as Google colab contains. Jupyter notebook. It allows the integration of notebooks, similar to how Google Docs handles documents. Colab integrates with many machine learning libraries and provides free access to GPUs.

2. Python: Python has a simple and clear working structure and a strong team. It easily interfaces with other programming languages such as C and C++. This open source language is known for its simplicity, extensibility and versatility.

3. Open CV: Short for Open Source Computer Vision, Open CV provides various libraries for real-time computer vision. It supports popular deep learning frameworks such as Tensor Flow, Torch/PyTorch, and Caffe.

4. NumPy: NumPy is the main function library for analyzing data and counting arrays in Python. It plays an important role in matrix computation and is an important open source.

5. Pandas and Matplotlib: Pandas is a powerful open source data analysis and management tool that integrates with Python. Matplotlib is a general-purpose library for creating static, animated and interactive plots. Together they allow users to easily identify and view information.

6. Pillow (Python Image Library): Formerly known as PIL, Pillow is an open-source Python library that enhances image processing, including opening, editing, and saving various types of images. It enhances image processing capabilities and provides support for different pixel types, creating a solid foundation for image processing.

7. Tensor Flow: Tensor Flow is an open-Source data flow library that can be used for many tasks, including machine learning applications such as neural networks. Google uses it for both research and production due to its simplicity and availability across multiple platforms.

8. Image AI: Image AI is a Python library designed to simplify the integration of deep learning and computer vision into applications and systems. It allows developers, researchers, and students to create effective solutions with minimal coding.

9. Keras: Keras is an open source neural network library that simplifies the development of deep neural networks. It can run on platforms such as Tensor Flow, Microsoft Cognitive Toolkit or Theano. Keras emphasizes user-friendliness, modularity, and extensibility.

VIII. ADVANTAGES

1. Improve safety: Prevent head injuries and improve safety by defining helmet us
2. Compliance and enforcement: Enforcement of helmet and passenger safety.
3. Automation: Automatic search for accuracy and speed.
4. Data Collection: Collect data for analysis and response plans.
5. Immediate maintenance: Use immediately, complete immediately.
6. Non-intrusive: An easy-to-use method that does not require physical contact.
7. Technological Advances: Take advantage of advances in computer vision and ML
8. Public Awareness: Poor performance and security awareness.

IX. CONCLUSION*:*

Having imaging information about helmets and our equipment represents a major advance in safety and health in society. It covers the main topics of motorcycle safety and traffic management by reducing head injuries, enforcing regulations, providing instant alerts, collecting existing traffic benefits and supporting automation. As technology continues to evolve, these measuring devices must be accurate and effective, further improving safety and contributing to public health.

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