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Automatic Vehicle Plate Recognition And Over Speed Detection Using Machine Learning

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Abstract –

Objectives:- The main aim of this model is detect the over speed of the vehicle then plate detection and store the data of Vehicle person and speed limit details in file considering various factors causing accidents.

Reasons:- Road accidents are one of the disturbing events that constitute major loss. In India, it has become a major problem as it is claiming the lives of innocent people. Controlling the road accidents has become a crucial task. One of the reason behind the project is to prevent the road accidents increases day by day due to over speed in prone areas.

Methods:- We have detected the vehicle plate number from different angles using Deep Learning and Machine Learning and calculated the vehicle speed and also checks the accuracy of the speed.

Keywords:- Image segmentation, corner detection algorithm, Filtering algorithms, automatic Vehicle plate recognition, Machine Learning, Deep Learning etc.

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1. INTRODUCTION

In the recent years we can see there is a vast increase in the number of vehicles all around the globe. Along with the increase in number of vehicles increases the number of accidents. Therefore, it is important to limit the speed of the vehicles at certain zones or areas. Radar speed measurement tools are commonly used for this purpose which can be inaccurate in certain cases such as in sensing smaller vehicles with weaker echoes. Also it is difficult for these tools to detection in this part will calculate the speed if vehicle crossed the over speed limit then taking detect vehicles changing in speeds too certain cases such as in sensing smaller vehicles with weaker echoes. Also it is difficult for these tools to detect vehicles changing in speeds too often or fast. Therefore, there is a need for a better technique to detect the speed of the moving vehicles. The video stream of the moving vehicle is given as an input, then it is passed through the filter for detecting its speed. Our project is divided into two major part :- first part is speed photos of a car or a vehicle. And my project second part is plate detection in this part if the

vehicle crossed the over speed limit then detect the vehicle plate and convert into character using some processing and after the processing store the data of these plate in file. this file use in if these vehicle break the rule 10 time or any break limit number then automatically send the alert the vehicle person if you will in future break a rule then will cut your chalan.

1.1 MOTIVATION

As road accidents have increased recently, there is a need for a system for detecting speeding vehicles. And in the majority of cases, the main cause of the accident is speed. Even though all roads have signs indicating the maximum speed limit for driver safety, people are still not following the road speed limit. The project we are proposing is to develop a system that detects vehicles at speeds above the specified limit and immediately notifies the authorities concerned. The number of road accidents has increased recently, so we need a system to detect speeding vehicles.

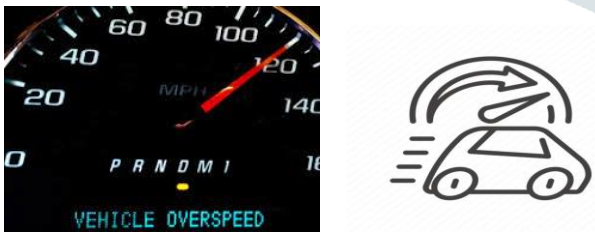

Fig. 1 Overspeeding car

Whereas this proposed system does not need human interception and records the speed of the cars as well as wirelessly informs speeding detection authorities. The methods used include the installation and operation of road-side speed sensors by police as shown in Fig.1.

2. Software and Languages used

2.1 Google Colab

Google Colab is the best project from Google based code, other Python-based third-party tools and machine learning frameworks such as Python, PyTorch, Tensorflow, Keras, OpenCV and many others. It runs on the web-browser. I facilitates us to share live code, mathematical equations, data visualization, data cleaning and transforma Colab is the best project from Google bastion, machine learning models, numerical simulations, and many others.

2.2 Python

Python is one of the most commonly used programming languages for these purposes. Its amazing libraries and tools help to carry out the image processing task in a highly efficient manner.

2.3 OpenCV

Open Source Computer Vision. This is one of the most popular tools for computer vision and image processing. It is used in a variety of applications like:-face detection, video capturing, tracking moving objects, object disclosure, nowadays in Covid applications such as face mask detection, social distancing, and many more.

3. Methodology

The Vehicle Plate and Speed Detection System using ML has been used to collect the information vehicle person who cross the speed limit. In this project there are two part :- first part is speed detection in this part will calculate the speed of a vehicle crossed over speed limt then taking photos of the car or thing. And in second part is plate detection in this part if the vehicle cross the speed limt then detect the vehicle plate and convert into character using some processing and after the processing store the data of these plate in file. this file use in if these vehicle break the rule 10 time or any break limit number then automatically send the alert the the vehicle person if you will in future break a rule then will cut your chalan.

3.1 Image Processing:-

• The image is processed useful information by applying some image processing techniques.

• After result image, the image converted into grayscale features which is to find the average color value from the three main color(r,g,b) that is red, green and blue showing in fig2.

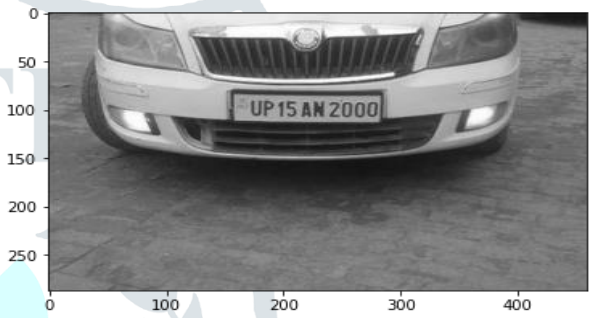

Fig2: image in grayscale

• After that, the grayscale image is process to the binarization and converter black and white that is for future use showing in fig2.

Fig3: Edge detection

• With the image in black and white, the system performs plate detection by searching through rectangle made up with all four white edges in the image which possibly contains the characters within showing in fig3.

• This step is work as if the characters may not be detected when the license plate portion is incorrect.

• After cropping the image of the detected plate, the system convert the characters into individual for the recognition purpose by using Connected Component Analysis Component Analysis.

Working Steps:- (1) Some Image processing

(2) Number Plate detecting

(3) Character convert

(4) At last Speed Detection

3.1.1 Image Processing :-

Converting the input image as shown in Fig 4 into grayscale format will also help the image binary (using python numpy) later as shown in Fig 5. It is the process of applying a threshold value to change the grey to the binary value which contain only 0 or 1 showing in image.

Fig4: Colorful Image

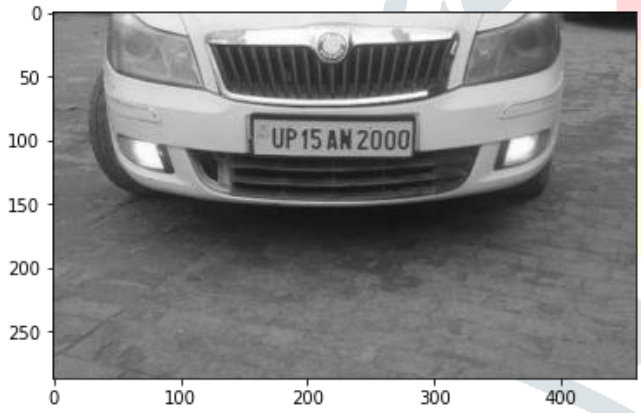

Fig 5: Grayscale

3.1.2 Number Plate Localization:-

License plate The location is the stage where the license plate of the larger scene is related. The name plate location is identified and the output will be one containing only the name plate. Finding the license plate from the full picture can be performed or used by the Sobel Mask Technique. It is commonly used to detect edges in the picture.

It determines all contours of the user's image.

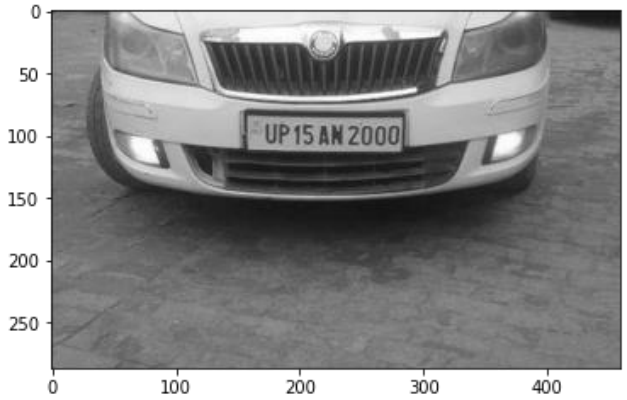

Fig 6: Grayscale

3.1.3 Character Segmentation:-

A bilateral filter is a non-linear filter for sound reduction and smoothing. Next, a two-way filter is applied to the grayscale image. A bilateral filter is an edge-preserving, non-linear, noise reduction, and smoothening filter. Each pixel is replaced by the weighted intensity values of the adjacent pixels. In particular, it preserves the edges while suppressing noise in the image. After the edges are found, the contours are drawn. The output image segmented character is sent as input for character recognition showing in fig 7.

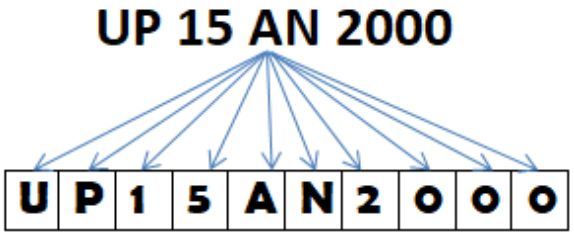

Fig 7: Character segmentation

3.1.4 Speed Detection

Our important need is to get the live stream of the moving vehicle using a camera. For this purpose, we make use of OpenCV. The video captured from the camera is converted to gray scale for further processing. A Video Capture object is created for getting a live stream video. Its debate can be either the contraption report or the name of a video record.

The vehicles move at a constant speed and with a straight trajectory from the lower to the upper part of the image; and the license plates are at approximately the same distance from the ground.

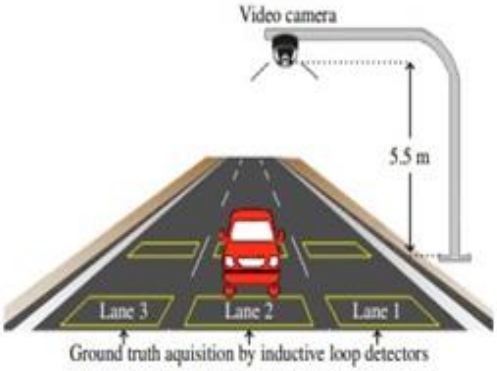

Fig 8:Ground truth acquisition by inductive loop detectors

After scanning the image series from the video, the trucks are detected using OPEN CV. The template for the classifier is trained with many positive and negative images to create an XML file. This results in vehicle tracking and speed estimates using their respective locations, in ppm (pixels per meter) and in frames per second (frames per second).

Vehicles travel at a constant speed and with a right track from the bottom to the top of the image, and the number plates are roughly the same distance from the ground.

These assumptions allow us to measure the speed of vehicles without modelling the 3D space, nor requiring accurate calibration or positioning of the camera.

- How To Calculate the speed of vehicles:

$$\text{Speed b/w A and B} = \frac{4}{\textit{Total time taken by vehicle}} = \frac{4}{0.5\ s}$$

$$\text{Speed b/w B and C} = \frac{4}{\textit{Total time taken by vehicle}} = \frac{4}{0.7\ s}$$

$$\text{Speed b/w C and D} = \frac{4}{\textit{Total time taken by vehicle}} = \frac{4}{0.7\ s}$$

$$\text{Then Average Speed} = \frac{A\&B + B\&C + C\&D}{3} = \frac{8+5.71+5.71}{3} = 6.47 M/S$$

Some parts are clearly mentioned in the flow chart.

Project Flow Chart:-

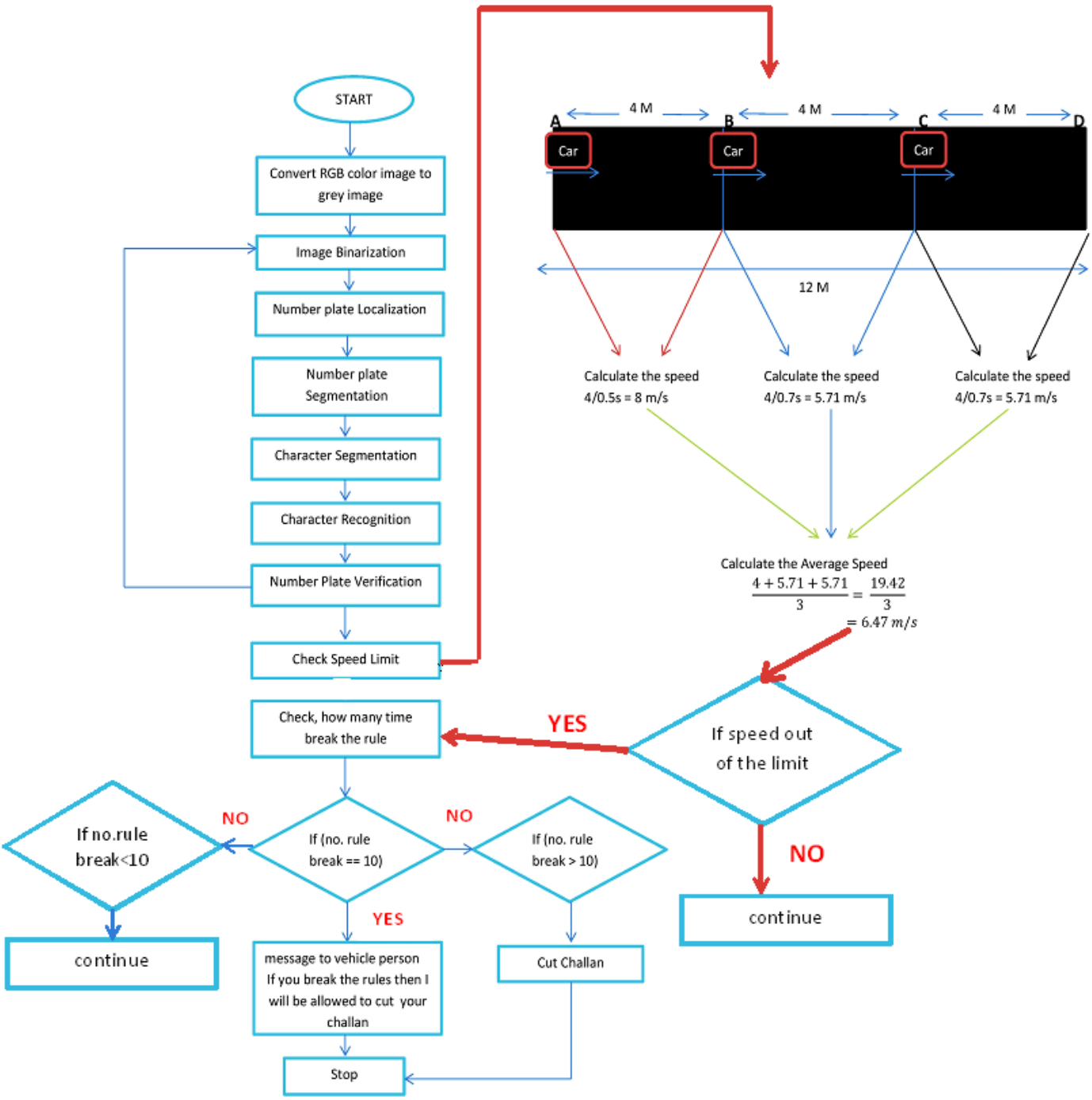

Fig.9 Project Flow Chart

Methodology- Flow Chart in detail:-

Step1: Convert RGB color image to grey image –

Various reasons Convert RGB color image to grey image :-

- Signal to noise = For many applications of image processing, color information doesn't help us identify important edges or other features. There are exceptions. If there is an edge (a step change in pixel value) in hue that is hard to detect in a grayscale image, or if we need to identify objects of known hue (orange fruit in front of green leaves), then color information could be useful. If we don't need color, then we can consider it noise. At first it's a bit counterintuitive to "think" in grayscale, but you get used to it.
- For learning image processing = it's better to understand grayscale processing first and understand how it applies to multichannel processing rather than starting with full color imaging and missing all the important insights that can (and should) be learned from single channel processing.
- Difficulty of visualization

Step 2: Image Binarization - Binary image is sufficient for OCR. Algorithm needs to recognize characters, they can be represented with one color and there is background which can be represented with second color. This also makes algorithm fast because it has less data to deal with.

Step 3 : Number Plate Localization:- License plate The location is the stage where the license plate of the larger scene is related. The name plate location is identified and the output will be one containing only the name plate. Finding the license plate from the full picture can be performed or used by the Sobel Mask Tecnique. It is commonly used to detect edges in the picture.

Step 4: Number plate segmentation:- License plate recognition usually contains three steps, namely license plate detection/localization, character segmentation and character recognition. The segmentation step may be affected by many factors such as license plate boundaries (frames).

Step 5: Character Segmentation : A bilateral filter is a non-linear filter for sound reduction and smoothing. Next, a two-way filter is applied to the grayscale image. A bilateral filter is an edge-preserving, non-linear, noise reduction, and smoothening filter. Each pixel is replaced by the weighted intensity values of the adjacent pixels. In particular, it preserves the edges while suppressing

noise in the image. After the edges are found, the contours are drawn. The output image segmented character is sent as input for character recognition.

Step 6: Character Recognition : Character recognition is a process which allows computers to recognize written or printed characters such as numbers or letters and to change them into a form that the computer can use.

Step 7: Number plate verification : verify the plate number, it is valid or not, if not check again in plate detection system part.

Step 8: Check speed limit : The vehicles move at a constant speed as shown in Fig 10 with a straight trajectory from the lower to the upper part of the image; and the license plates are at approximately the same distance from the ground. this part if the vehicle cross the speed limt then detect the vehicle plate and convert into character using some processing and after the processing store the data of these plate in file. this file use in if these vehicle break the rule 10 time or any break limit number then automatically send the alert the the vehicle person if you will in future break a rule then will cut your chalan.

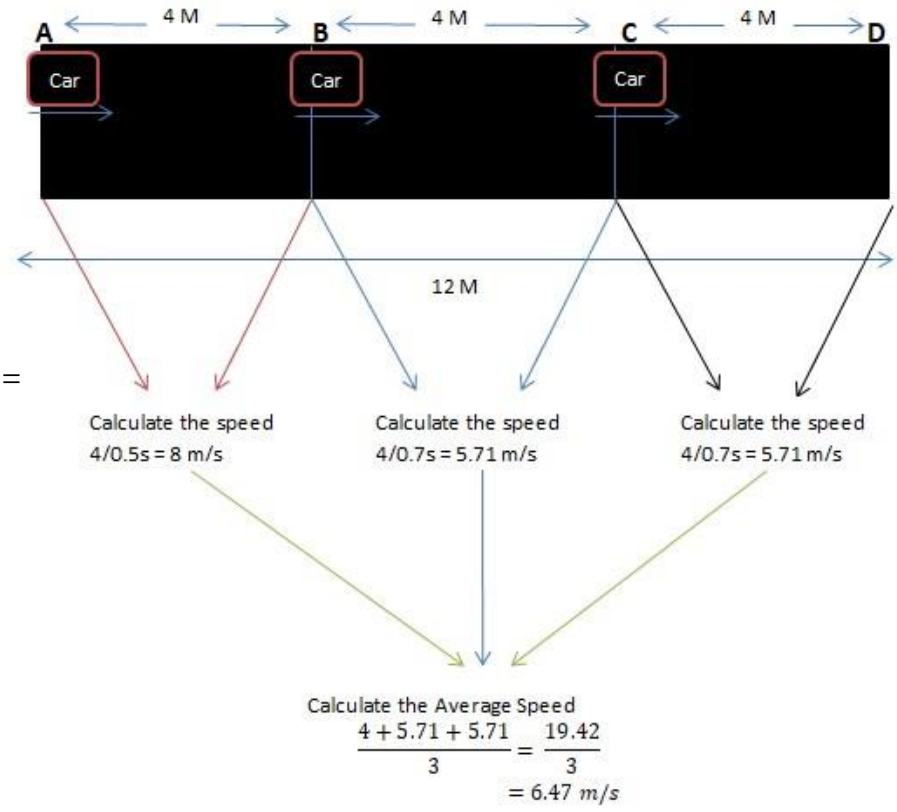

Fig 10: Calculating average speed =

Step by step working of algorithm:

1. START
2. Convert RGB color image to gray image.
3. Image Binarization.
4. Number plate localization.
5. Number plate segmentation.
6. Character Segmentation.
7. Character Recognition.
8. Number plate verification.
9. Check speed limit

   9(a). If speed > 80kmph : GOTO Step 10

   9(b). If speed <= 80kmph : CONTINUE

10. Check the past record for number of rule break by the driver.

    10(a). If no. of rule break < 10 : CONTINUE

    10(b). If no. of rule break = 10 : Give warning to the driver that you'll be charged with penalty/challan if next time you break the rule.

    10(c). If no. of rule break > 10 : Cut challan.

RESULT AND DISCUSSION

Convert the input image into grayscale format will also help the image binarization(using python numpy) later. Binarization is the process of applying a threshold value to change the grey to the binary value which contain only 0 or 1. The edge dection of the number plate from the entire image can be performed or used by the Sobel mask. Sobel mask is commonly used for edge detection in image processing. It defines all the edges in the input image. After cropping the license plate, the next step is character segmentation. Character segmentation is to separate the alphanumeric character on the license plate individually.

Thus, the characters are needed to be transformed to an array of numerical data. It can be achieved by using the Vertical Projection Profile (VPP). VPP is to determine the brightest colour and also the darkest which match the normal colour of a number plate. In this way, the computer can know the gap between each character and separate accordingly.

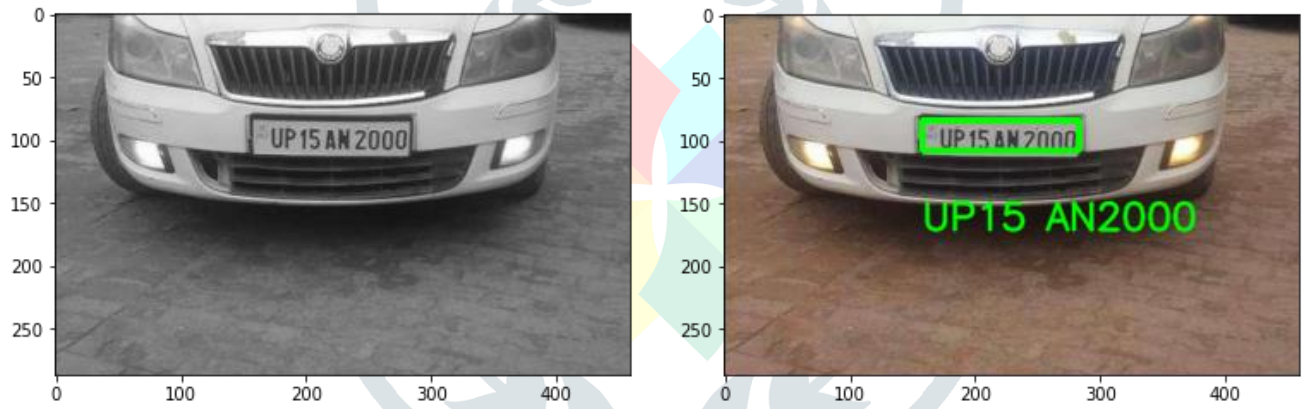

Fig11 : In this figure showing user input vehicle image and convert into number plate Recognition with plate

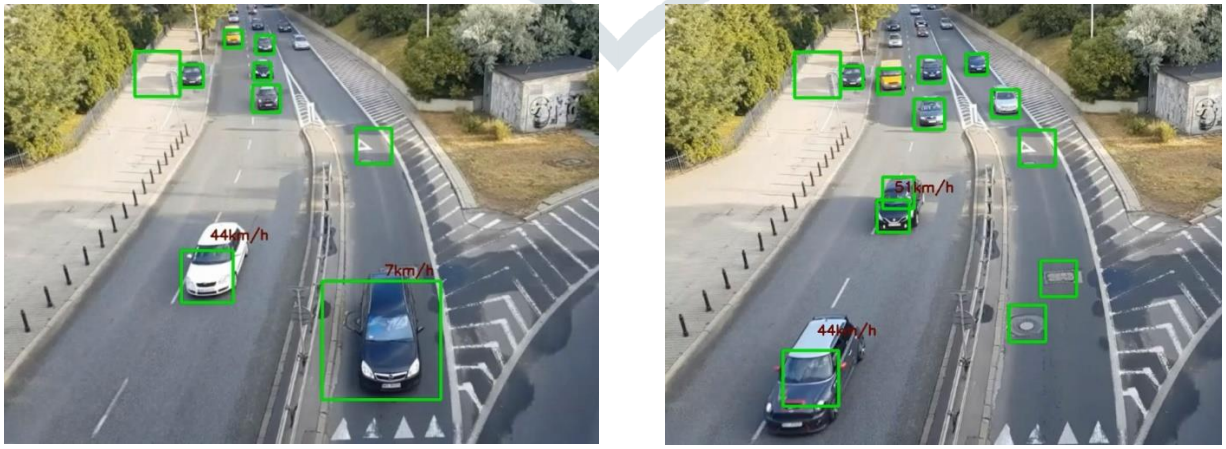

Fig 12: Show speed of Vertical in this figure

Conclusion

This discussion paper provides a concise description of vehicle licence plate detection and reconnaissance techniques used for effective traffic monitoring and method reliability observation. In the construction of an intelligent transport network, vehicle number detection and a reconnaissance system are important. Even though identification of vehicle number plates has always been a problematic approach for some reasons especially for changes in lighting, flame, non-uniform type of license plate, various styles, and color effects in the environment. The recognition may also use certain image processing techniques in conjunction with neural networks to identify digital plate characters, moving distance images, numbering schemes, Angulated or Lateral view images. In this study, methods of detecting and identifying vehicle registration plates were classified according to their accuracy. In the future, it is preferable to use high-resolution cameras with an enhanced number of images for better performance and efficient recognition of licence plates.

The classification section can be further improved due to complexity, speed and time sequence. This study includes an in-depth assessment of future progress and trends in the identification and knowledge of license plates of newer vehicles that could be useful to researchers.

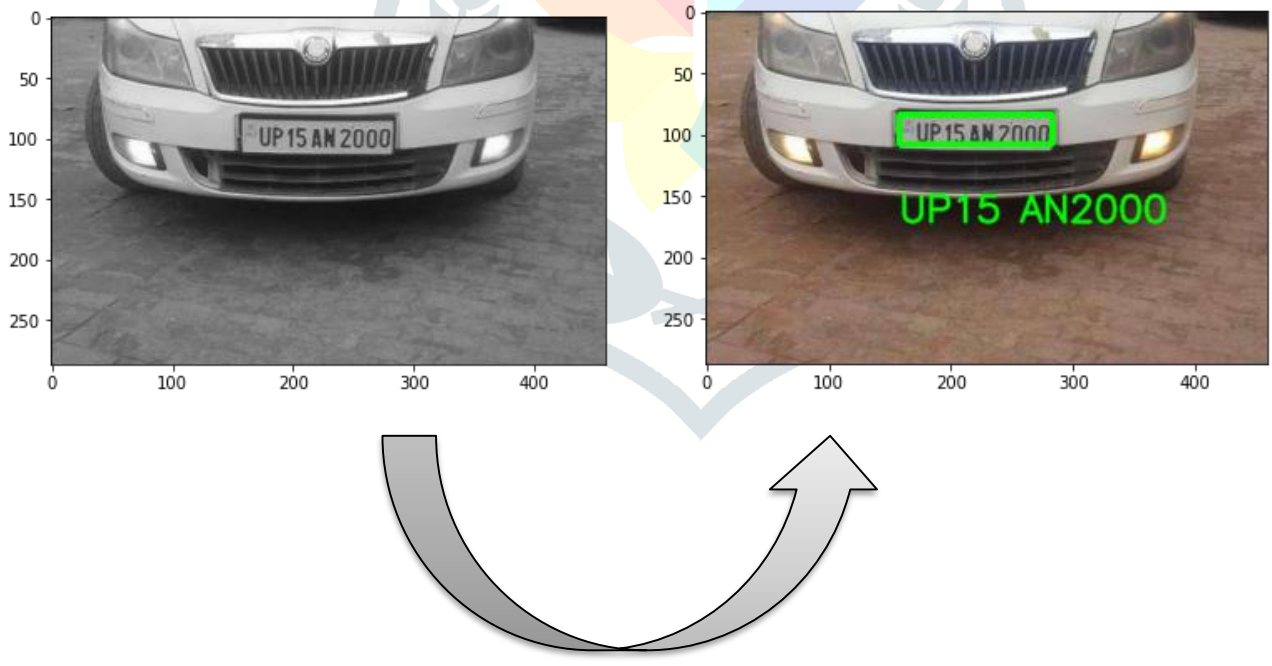

Fig13 : In this figure showing user input vehicle image and convert into number plate Recognition with plate number.
And Accuracy is 95% in this image.

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