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# Velocity Estimation and Speed Tracking Through Segmentation

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***Abstract :*** Road safety is the major issue in the world. Instead of strict traffic rules many users un-commitment leads to accidents. One of the basic problems in road safety is speed limits. Speed limits differ from place to place and country to country. India is the first country in the road accidents throughout the world approximately 2,38,562 per year. Recommended speed limit on express high way in India for LMV (light motor vehicle) is 60km/h and HMV (Heavy motor vehicle) is 100 km/h. This paper deals with efficient algorithms which are designed on velocity Estimation, speed tracking and image extraction. This system uses simple algorithms instead of using complex algorithms and easily implemented on MATLAB by some simple calculations. After the capture of video there are two steps in this procedure, Firstly speed is tracked using the threshold values and lastly Image is extracted from the video compared with database and thus concerned authorities can be notified using the Gmail interfacing. This system works on real time applications, some advanced hardware is used. An intensive image processing approach is suggested and analyzed for estimation of speed of vehicle. Promising results are generated with perfect segmentation and interfacing.

***Keywords :*** Camera Calibration; Object Tracking; Velocity Estimation; Video Image Processing; Speed; Matlab.

## 1. INTRODUCTION

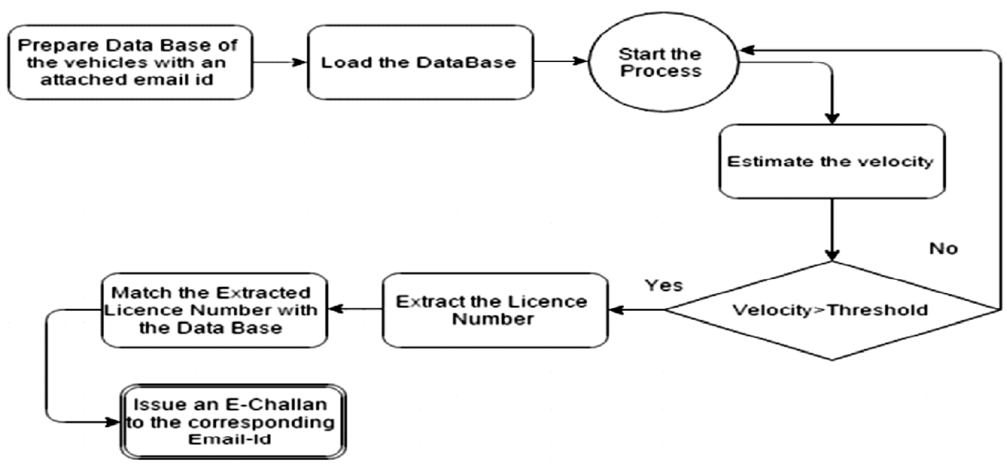


**Fig. 1. Flow Chart for the Designed System.**

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Video surveillance is an important aspect in today's day to day life, and plays an important role in the security. The increasing number of accidents brings the idea of tracking the speed of vehicles on road. To make it more automatized, MATLAB can be linked to the mail servers [7]. The below flow chart are the steps to follow the procedure:

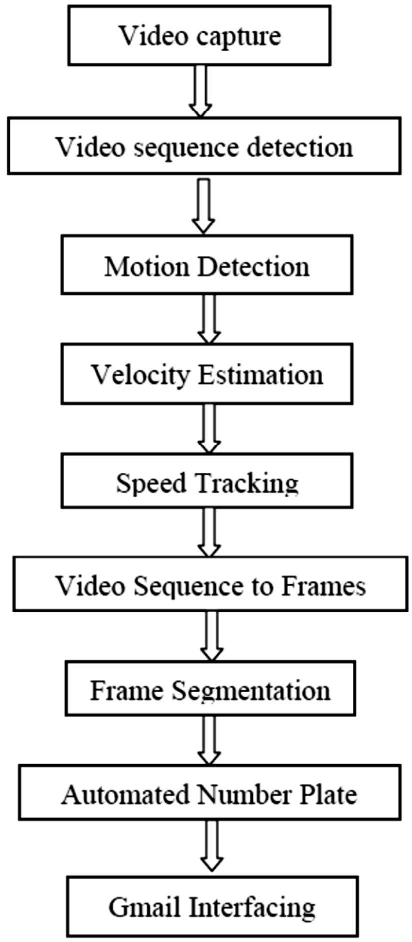


**Fig. 2. Sequence of Steps for the Designed System.**

Now to understand the process, a simple example is given below explaining all the internal details of the concerned system. Our setup includes a camera, a laptop containing the MATLAB software, a speeding car or any vehicle [9, 13]. Now, suppose a car is approaching towards the setup. As soon as the camera detects the car, first it will estimate the velocity of the car. The objective that has been worked upon in this research is basically divided into certain parts to understand the system without much effort. The main parts of the system are as follows: Motion Detection, Velocity Estimation, Speed Tracking, Automated Number Plate Recognition and Gmail Interfacing [1, 11, 15].

While motion detection makes use of the knowledge about the frames and the pixels, velocity can be estimated by the calculations and algorithms [16]. Automated Number Plate Recognition (ANPR) can be implemented using the different morphological image processing techniques on the snapshots of the vehicle or the number plate [2, 4, 6].

## 2. VELOCITY ESTIMATION

The velocity of the car is estimated by a proposed algorithm. When the car was at some distance from the camera, it would be of very small size to the camera and when it would be near to the camera, it would be of large size. So as the distance travelled by the car increases, the area of the car detected by the camera increases. After a few observations, you can find the proportionality constant which in my case came to be 0.15.

Distance travelled = 0.15 *Change in the area of the car.

The speed of the car can be detected by the basic formula *i.e*.

Speed = Distance/Time

Where, the time is amount of time taken by the camera to detect the car. This time can be fixed.

After the calculation of velocity, the velocity of the car will be saved. The saved velocity will then be compared with threshold velocity which is the speed limit for that particular road. It can be changed in the software. The system will then compare the saved velocity with the speed limit [8, 14]. If the speed limit will be greater than the saved velocity, the camera will detect the number plate with the help of different morphological operations including dilation and erosion, vertical and horizontal edge detection etc. [3, 10]. The proposed algorithm is given as below:

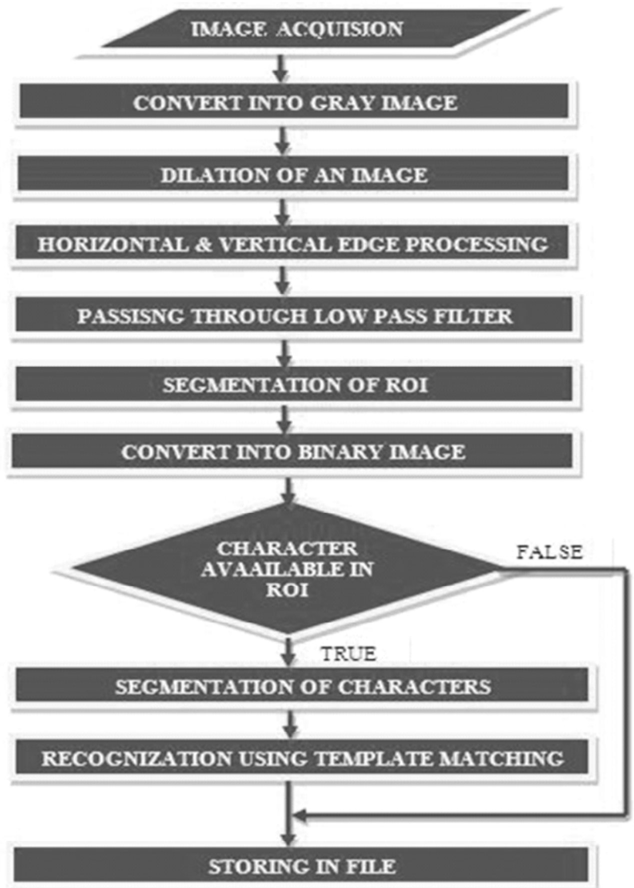


**Fig. 3. Proposed Algorithm.**

After the detection of the number plate, the number will be scanned through the datasheet and if a match is found, the email id of the corresponding car owner will be extracted and though the software is interfaced with mail servers, software will mail the corresponding owner an e-challan including the details of the submission of Challan.However, the presence of noise and heavy clutter inferences makes difficult the task of consecutive detection and tracking. An improved system concept involves a processing method, which allows preceding data to help in target detection. For example, the Hough transform techniques detect the existence of tracks using a batch of frames. The effectiveness of the Hough transform in achieving improved radar system detection performance is shown in a number of publications. Since the information is collected over multiple observation intervals, a target state estimate, including position and velocity, can be obtained during the detection process. In the present paper, two techniques for target velocity estimation in the framework of Hough transform detection scheme are considered. The Hough transform is a well-known technique used to identify straight lines in a noisy environment. In the context of radar application, the measurements from a straight-line target are collected in stationary bins (or accumulators), which are formed over the Hough parameter space. A track is detected, if the accumulated sum of measurements within each bin exceeds a detection threshold. Then, based on the accumulated measurements, track initiation and confirmation algorithms can be utilized for estimating target kinematics parameters [12, 16]. The first proposed algorithm is a sequential tracking filter, which is applied to the ordered by time measurements inside detected bins. It is assumed, that the target has a random location, random speed and heading angle in the observed space. Two-point differencing track initiation procedure is implemented, followed by a nearest neighbor Extended Kalman.

The numerical and graphical results show that the Hough estimator guarantees higher estimation accuracy than the Doppler estimator if the parameter space is sampled with an appropriate sampling step. In order to decrease computational burden of the Hough estimator, the trajectory detection can be done in two stages. At the first stage the Hough parameter is sampled with a large sampling step, and a rough velocity estimate is found. At the second stage the Hough parameter space is sampled with a very fine sampling step, and a fine velocity estimate is calculated. At this stage the sampling step must be chosen in order to meet the accuracy requirement.

## 3. RESULTS

First GUI is created which shows the video sequence in a black box, the speed of the vehicle in kilometers per hour and load database is to load all the vehicle numbers which is used for testing purpose, all these specifications are shown in the figure 4.


**Fig. 4. Video sequence GUI.**

Second GUI shows the clear picture of the extracted image where the number plate is extracted from the captured video frames. The extracted number is typed manually in the simulation and file is loaded. After loading the email id is visualized in GUI as shown in figure 5. which is used for further processing.


**Fig. 5. Image Extracted GUI.**

Lastly interfacing is done and mail is sent to the generated email ID, where the user needs to go to the RTO office and pay the tentative amount. The received email is shown in the figure 6.

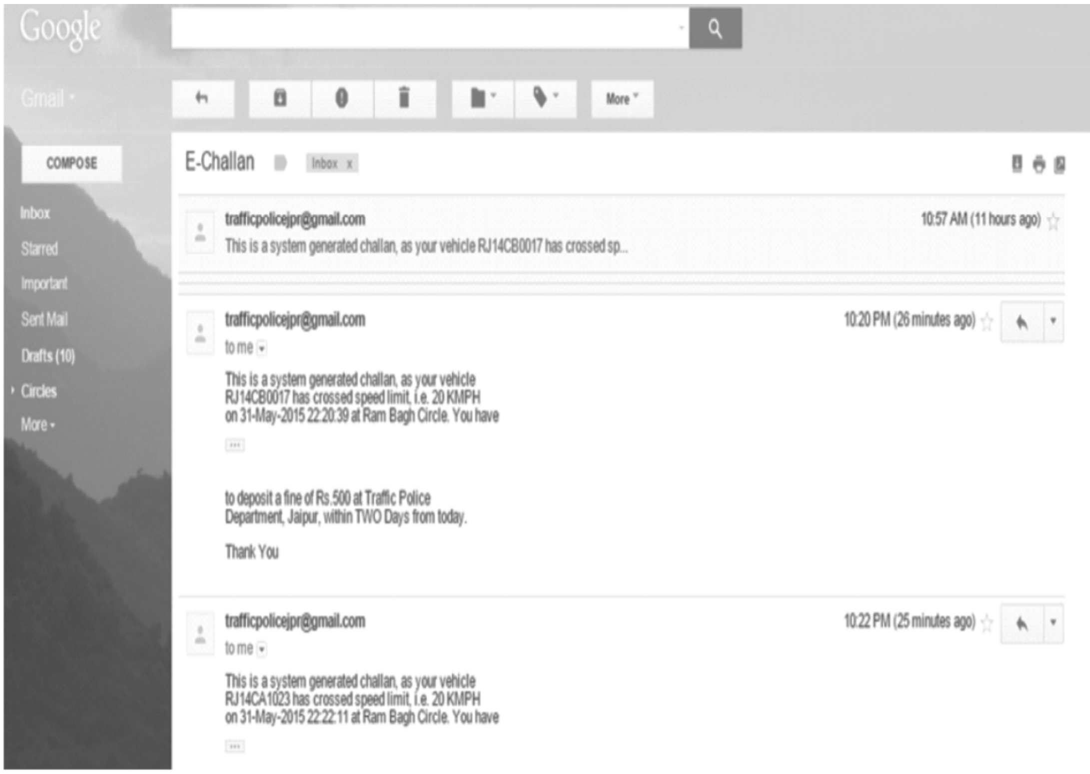


**Fig. 6. Received Mail.**

## 4. CONCLUSION

Effectively video is captured first and then frames are separated form the video. Efficient image processing approach has been suggested on every frame and analyzed for estimation of speed of vehicle. The estimation of velocity in MATLAB can be calculated using assumptions and calculations instead of using the complex algorithms. After the speed estimation a mail is dropped to the registered user by interfacing to pay the attentive amount in the RTO (Regional transport office).The image segmented and recognized is matched with the database and properly processed. Further scope for system developer is to use different segmentation and recognition algorithms to increases the speed of this system. Runtime can also be used with related efficiency.

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