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Penalty Generation System and Traffic Violation Detection at a Street Intersection

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Abstract— Due to urbanization and industrialization there is rapid increase in number of vehicles running on the roads. This has resulted in frequent traffic jams, signal violation and accidents at the street intersection. Also it is not possible to assign a traffic police at each and every street. This generates the need for proper penalty system depending purely on video processing techniques.

Keywords *Violation detection· Lane change· Traffic penalty*

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I. INTRODUCTION

The number of accidents on roads has increased in recent times. A majority of these accidents occur at road junctions [1], when the drivers do not obey red light rules. There is a tendency among the drivers to change lanes before the stop line to avoid delays. With advances in signal processing and computer vision technology many image-based solutions have been proposed to monitor the traffic junctions.

Chen and Yang [2] have proposed a system for red-light violation detection of vehicles in the detection region, which is based on analysis of vehicle movement. Lim et al. [3] have proposed a system that detects almost all violations at road junctions such as red light violation, speed violation, stop line violation, and lane change violation by tracking individual vehicles. Both the systems depend on inputs from the traffic signal box. If there is any error in functioning of the traffic signal box, then the systems may give wrong outputs. Lai et al. [4] have proposed a system to detect color image sequence by using a stationary background estimation algorithm. The algorithm implies running mode and running average algorithms that are commonly used for background estimation. It is very important to store the true position of vehicles for red light violation detection. Sochor [5] has proposed a technique for tracking the vehicles in real time with the help of lanes analysis using kalmanfilter. All the systems mentioned above have not assigned any technique for generation of penalty. A proper penalty system will help in improving discipline among the drivers.

This paper proposes a system, totally independent of interconnections from the traffic signal box. This independent system works only on video monitoring at junctions. The violations detected are used to generate penalties, assisted by an android application. The paper is organized as follows: Section 2 describes the methodology for traffic violation detection using video processing. Section 3 describes penalty system based on android application. Section 4 shows the results and in Sect. 5, we conclude the paper.

II. TRAFFIC VIOLATION DETECTION

The main causes of traffic jams and accidents at a signalized junction are lane change and red signal violation. To avoid these incidents many systems have been deployed in the past, ranging from simple devices like inductive loops, laser-based devices to traffic light queue control system [6, 7]. These systems devices to traffic light queue control system [6, 7]. These systems heavily depend on the signals from the traffic signal

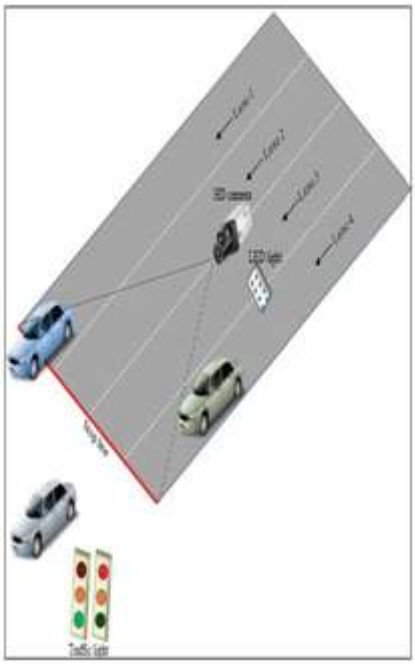

Fig. 1 An overview of purely video processing violation detection system

A.Video Capture and Setting Detection Region

Upon initialization, the cameras start basic monitoring of the area. Setting up of the detection region as shown in Fig.3includes marking of stop lines, different lanes and traffic signal location, using a simple graphical user interface (GUI). The pixels in region within the lines are considered and others will be ignored.

The detection region are all of pixels inside the yellow line, thus the pixels outside the detection region are zero. The detection region should have a certain length for computation of vehicle speed and vehicles movement behavior. The detection region helps reducing the computation complexity of the algorithm for vehicles movement due to only pixels interior of the yellow line are computed

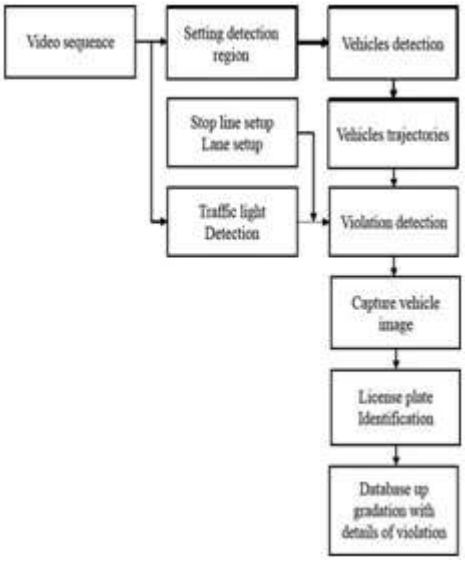

Fig 2.Blocschematicdiagram for traffic violation detection

B.Identifying the Red signal

The basic requirement to detect red-signal violation is to check whether the signal Algorithm used for detection of traffic signal: Acquire single frame and extract the red layer matrix from the RGB frame. Get the gray image of RGB frame. Now subtracting the gray frame from the red frame and filtering out unwanted noise using median filter. Convert filtered frame into corresponding binary image. From the binary image, get the centroids and bounding boxes of the blobs. Centroids are converted into integer for comparing it with the marked detection region (green box) co-ordinates. If centroid co-ordinates found inside the marked detection region, pixels takes value as 1. So, the red signal is detected in the region of interest.

Algorithm used for detection of traffic signal: Acquire single frame and extract the red layer matrix from the RGB frame. Get the gray image of RGB frame. Now subtracting the gray frame from the red frame and filtering out unwanted noise using median filter. Convert filtered frame into corresponding binary image. From the binary image, get the centroids and bounding boxes of the blobs. Centroids are converted into integer for comparing it with the marked detection region (green box) co-ordinates. If centroid co-ordinates found inside the marked detection region, pixels takes value as 1. So, the red signal is detected in the region of interest.

C.Vehicle Detection

Once the red signal is detected, the system looks for any vehicle inside the yellow box region. For detection of vehicles, most of the methods [6, 8] assume that the camera is static and then desired vehicles can be detected by image differencing. In Frame differencing [9], pixel-wise differencing between two or three consecutive frames in an image sequence is used to detect the regions corresponding to moving object such as human and vehicles. In this technique an absolute difference is taken between every current image *It*(x,y) and the reference background image *B*(x,y) to find out the motion detection **5**

CONCLUSION

The proposed violation detection system shows high performance in terms of accuracy for both lane change and red-signal violation detection. The traffic violation detection system works with purely video processing technique. A number of features have been noticed. First, this method offers a mobile, robust, and cost effective solution as it works efficiently without needing any signal from traffic.

Penalty Generation System and Traffic Violation Detection … signal box or buried loop detectors. The set up process is simple and fast. The violation type classification rate is 100 %.

This paper proposes a penalty system using android application which can be used for multiple approaches such as to charge violator with fine, to update vehicle owner details in database. This idea will reduce small amount of bribery percentage in India.

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