International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 02 | Feb 2021 www.irjet.net p-ISSN: 2395-0072

# Traffic Signal Violation E-Fine System

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**Abstract -** *In India, traffic, road rage, accidents have become a very serious issue and must be taken under consideration. Breaking rules in any manner is bound to attract punishment. The level of the punishment is based on the type of the committed offense. The number of road accidents and even death rate is increasing. As per the report, about 300,000 accidents take place yearly, and over 80,000 people die due to accidents. Hence due to this problem, we decide to develop this project, our project monitors the vehicles and fines the culprit vehicle whenever the signal is violated. When the traffic signal is red cars should stop beyond that limit line if they failed it is considered as a traffic violation. It checks if the signal is red and using camera module checks if any car crosses the limit line it takes the image of the car's number plate and compares the car's license plate number from the database and generate the E-fine and send the E-fine receipt to the defaulter through Email id. For the database, we have used the MariaDB server which is linked with Raspberry Pi 3. Record corresponding to extracted vehicle number is considered as culprit record and E-fine is sent to that particular registered mail ID.*

***Key Words*: *traffic signal, E-Challan, Signal violation, limit line.***

## 1. INTRODUCTION

Preventing general traffic violations is not easy on roads due to inattentive drivers. This small violation is one of the leading causes of accidents. The ease of travel is affected by such factors as the quality of the road, congestion, time is taken, accidents, speed, etc. Lack of discipline and emotions of road vehicle users cause traffic congestions which might lead to traffic violations. Having a safe and free flow of traffic is crucial for the economic development of the country as we must ensure spending less on fuels and less time on the road. Due to a large number of vehicles on the roads the Traffic enforcement authorities unable to scan every vehicle on the road. One of the major problems is the number of vehicles present, in some cases, there are more than 3 to 4 cars owned by a single human which causes more traffic congestion due to lack of parking availability. Another problem is corruption, the traffic authorities may take bribe from traffic violators instead of the decided fine amount by the government. To promote safe & sustainable mobility in India, we thought to develop a system as Traffic Signal Breaking E-Fine system. Thus, our project will help in the reduction of accidents, road rages and also will stop corruption.

### 1.1 Proposed System

Using the camera images are captured and videos taken are converted to the image sequences. Each image is processed separately, after processing the image if the vehicle breaks the signal the number plate of that vehicle is identified from that image with the help of image processing, and it is done in OpenCV after getting the clear image of the number plate it is converted into the text with by tesseract and that vehicle number is searched in the database which contains the information about the vehicle owners. Then based on provided E-mail id by the owner our system will send the E-Challan on that email id.

### 1.2 OpenCV and Pytesseract

OpenCV is an open-source programming library that is developed by Intel. OpenCV is python-based library hence it's easy to learn. OpenCV has the flexibility to capture images from a live video stream or prerecorded stream. OpenCV can denoise the image. In OpenCV, we had implemented the Canny Edge detection algorithm which is used for detecting edges of images and useful for detecting a car's number plate characters.

Python-tesseract is an Optical Character Recognition (OCR) tool for python, Py-Tesseract is a standalone script as it can read all images supported by the Pillow and Leptonica imaging libraries it can recognize more than 100 languages. It can be trained to recognize other languages. Tesseract OCR accuracy is fairly high and can be increased significantly with a well designed Tesseract image preprocessing pipeline.

## 2.METHODOLOGY

This section discusses project system architecture and the required technologies to create it. This system recognizes and reads vehicle license plates using OpenCV and Optical Character Recognition. The camera module continuously captures the frames, it saves the last frame as a new image. After that, it uses the contour function from OpenCV to detect the license plate. Finally, Raspberry Pi crops out that selected area and perform optical character recognition to read the license plate numbers. Here only Raspberry Pi and camera are used to build this Raspberry Pi Plate Recognition System. After the characters are extracted then the vehicle

number is obtained and then the same number is been searched in the database. Once the number is encountered in the database the detailed information about the driver/owner can be extracted.

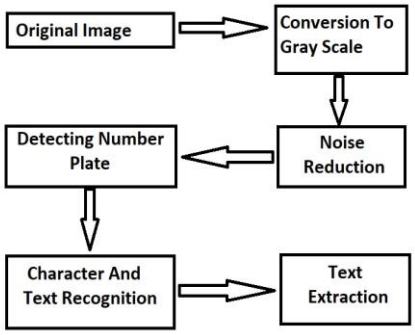



**Fig -1**: **Proposed Methodology of the System**

First Input the image of the car captured for RGB(red green blue) to a grayscale image The image that is acquired from the camera(input) can be an RGB color image or a grayscale intensity image. Then We intended to use median filters-low pass and high pass filters used to correlate the pixels neighboring and this can reduce the noise. After In image binarization certain threshold is chosen to classify certain pixels as black and certain pixels as white. Then for Edge detection, It is the principle technique for feature detection or feature extraction of vehicle number plate. In image recognition, this technique is used for finding small parts of an image. Next, the Histogram Approach is an equalization method to process images to adjust the contrast of an image by modifying the intensity distribution of the histogram. The histogram plots the number of pixels in the image (vertical axis) with a particular brightness wave (horizontal axis).
This system automatically recognizes and reads the vehicle license plates using OpenCV and Optical Character Recognition. The Raspberry Pi camera module continuously captures the frames, and when a key is pressed on the keyboard, it saves the last frame as a new image. Then it uses the contour function of OpenCV to detect the license plate. And finally, the Pi crops out that particular area and perform optical character recognition to read the license plate numbers. The main objective is finding out the traffic rule breakers and E-fining them. This will reduce human intervention and will also reduce the risk of traffic police chasing the signal breakers. And for that, the culprit details will be fetched from the database and the culprit vehicle owner will be E-fined on mail.

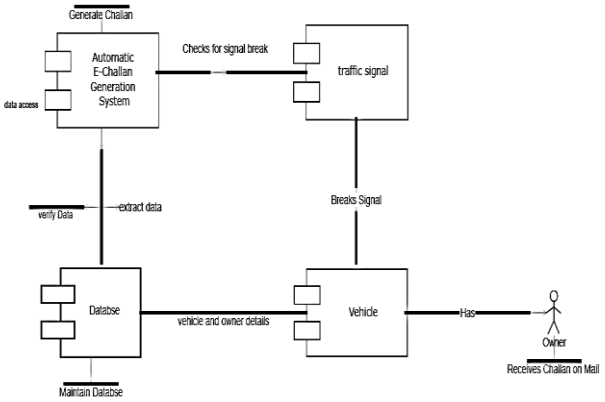



**Fig -2**: **Component Diagram of proposed system**

Steps and Algorithms Used:

**2.1 Initialize Pi Camera:**

Initialize the camera module and set the resolution at (640, 480) and the frame rate at 30 fps.
camera = PiCamera()
camera.resolution = (640, 480)
camera.framerate = 30

**2.2 Capture Continuous Function:**

Then use the capture continuous function to start capturing the frames from the Raspberry Pi camera. For frame in camera.capture_continuous(rawCapture,format="bgr", use_video_port=True):
image = frame.array
cv2.imshow("Frame", image)
key = cv2.waitKey(1) & 0xFF
rawCapture.truncate(0)

**2.3 Bilateral filter:**

After capturing the last frame, it will use a bilateral filter function to remove the unwanted details from the image.
if key == ord("s"):
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY) #convert to grey scale
gray = cv2.bilateralFilter(gray, 11, 17, 17) #reduce noise

**2.4 Canny Edge Detection Algorithm:**

After removing the unwanted details, the Canny Edge Method is used to perform edge detection.
edged = cv2.Canny(gray, 30, 200)

**2.5 Contours Detection**

Now we will find for contours on our image. After that sort the detected contours in descending order.

```
cnts = cv2.findContours(edged.copy(), cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
cnts = imutils.grab_contours(cnts)
cnts = sorted(cnts, key = cv2.contourArea, reverse = True)
screenCnt = None
```

The Raspberry Pi can find multiple contours, so we have to filter the license plate contour by searching for a rectangle shape contour and a closed figure among the obtained results. After finding the license plate, cover up everything except the license plate

```
mask = np.zeros(gray.shape,np.uint8)
new_image = cv2.drawContours(mask,[screenCnt],0,255,-1,)
new_image = cv2.bitwise_and(image,image,mask=mask)
```

After covering the entire image except the license plate area, we will crop out the license plate area and save it as a new image.

```
(x, y) = np.where(mask == 255)
 (topx, topy) = (np.min(x), np.min(y))
(bottomx, bottomy) = (np.max(x), np.max(y))
Cropped = gray[topx:bottomx+1, topy:bottomy+1]
```

### 2.6 SMTP Mail Setup for Raspberry Pi Car Plate Recognition

SMTP (Simple Mail Transfer Protocol) is the protocol for providing email services on a TCP/IP network. SMTP provides the ability to receive and send emails. We are using SMTP to send a mail when the Raspberry Pi detects and recognizes a license plate.

```
server=smtplib.SMTP('smtp.gmail.com',587)
server.sendmail("abc@gmail.com","abc12@gmail.com",text)
```

### 2.7 Grep: To search string of characters:

Grep stands for Global Regular Expression Print.
Grep is a Linux / Unix command-line tool used to search for a string of characters in a particular file. The text search pattern in grep is called a regular expression. When it finds a match the same as input, it will print the line with the result. The grep command is commonly used when searching through large log files.

Example:

To print any line from a file that has a specific pattern or style of characters, in our case "phoenix" in the file sample2, run the command:

```
grep standard sample2
```

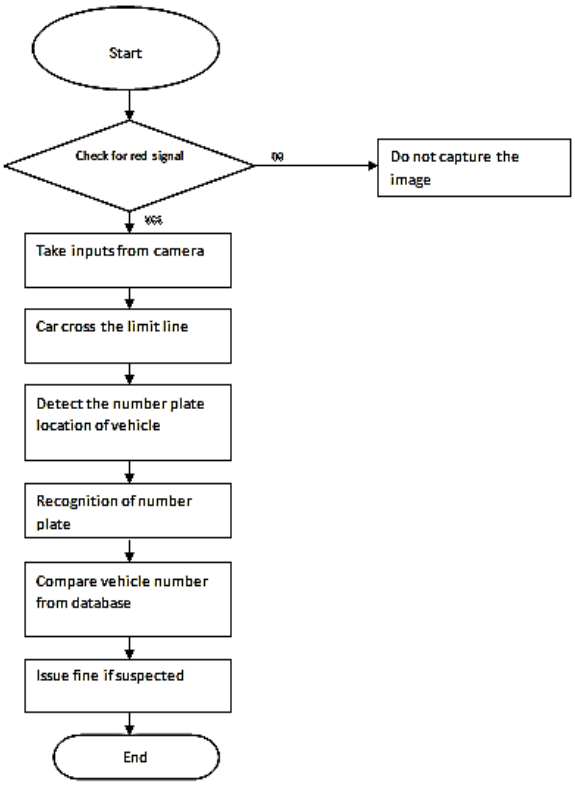
### 2.8 RegEx : To detect mail-id from string :

A RegEx, or Regular Expression, is a sequence of characters that builds a search pattern. RegEx can be used in cases like to check if a string contains the specified search pattern.

**Example :**

```
theemail=`grep -E -o "\b[A-Za-z0-9._%+-]+@[A-Za-z0-9.-]+\.[A-Za-z]{2,6}\b" hue.txt`
```

## 3.WORK FLOW




## 4. FUTURE SCOPE

### 4.1 Ambulance detection:

Whenever ambulance crosses the signal even when signal is red it should be captured by our system. This can be done with the help of OpenCV if we can detect ambulance siren or by using RFID.

### 4.2 Detecting bikers with no helmet:

This can be done by open cv. We have to detect the shape of helmet on head of the rider. If not detected, the rider is violating the rule and he/she must be fined. E-fine can be sent in the same way we did for our system.

### 4.3 Detection of over speeding:

Camera module can be used to detect over speeding of vehicle. But to detect the number plate of vehicle in such a fast motion we require camera of very high resolution.

## CONCLUSION

We are successfully able to detect the vehicle number plate and extract its number from its number using Open Cv. This is how we have built a Number Plate Recognition using Python and Raspberry Pi. Sometimes it fails to detect the license plate, or sometimes it reads some of the garbage values. Results largely depend on image quality and image orientation and also the camera quality. Using the camera of

high resolution will solve this problem. The clearer the image higher will be the processed image quality so that text can be extracted easily. Thus, our project will promote better traffic organization.

## ACKNOWLEDGEMENT

Working on the project on " Traffic Signal Violation E-fine System " was a source of immense knowledge to us. However, this would not have been possible without the equal support of all members. I sincerely express my deep sense of gratitude to our Asst. Prof. Deepali Kadam, for her valuable guidance, continuous encouragement and support whenever required and timely help given to us throughout the course of this work.

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## BIOGRAPHIES

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